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UNITED STATES NATIONAL MUSEUM
BULLETIN 202

FISHES OF THE MARSHALL AND MARIANAS ISLANDS

BY

LEONARD P. SCHULTZ AND COLLABORATORS:
WILBERT M. CHAPMAN, ERNEST A. LACHNER,
AND LOREN P. WOODS

VOLUME 2

Families from Mullidae through Stromateidae

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The scientific publications of the National Museum include two series known, respectively, as *Proceedings* and *Bulletin*.

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The present work forms No. 202, volume 2, of the *Bulletin* series.

Remington Kellogg,
Director, United States National Museum.

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Authorship of sections prepared by collaborators other than Leonard P. Schultz is indicated after the name of the group for which they are responsible. The appearance of my name as second author indicates that I furnished the ecological data and assisted in other ways but did not write major portions of the manuscript.

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INTRODUCTION

By **Leonard P. Schultz**

This is the second volume of U. S. National Museum Bulletin 202, "Fishes of the Marshall and Marianas Islands." The first volume was published on December 15, 1953. The third volume is in preparation.

A list of fish collecting stations, maps, and other information pertinent to the use of volume 2 were published in volume 1.

A few errors have been noted that we wish to correct:

p. 108, 3d paragraph last line should read 1949, not 1948
p. 166, since *Euleptorhamphus* is neuter the species name is *viride*, not *viridis*
p. 259, figure 39, *M. dunckeri* is figure "*a*" and *M. brevirostris* is figure "*d*"
p. 279, add p. 576 to Walbaum reference
p. 314, in section 5*a*, 4th line from bottom should read scales cycloid or ctenoid
p. 369, synonymy, Forskål, not Foskål
p. 386, *ocellata*, not *ocellatus*
p. 387, last line, soft, not saft dorsal
p. 407, 4th paragraph first line, Marston not Marsden
p. 537, *Monotaxis*, not *Montaxis*
pl. 26, A, name should be *Epinephelus horridus* (Cuvier and Valenciennes).

Except for the families by Ernest A. Lachner, I have supplied and mounted all the illustrations, and written the legends for them. If any errors were made, my collaborators should not be blamed.

FISHES OF THE MARSHALL AND MARIANAS ISLANDS

Volume 2

Family MULLIDAE: Goatfishes

By Ernest A. Lachner

Members of the family Mullidae are readily recognized by the two long, unbranched barbels below the chin, their bodies being moderately elongate and often brilliantly colored. Goatfishes are mainly inshore, bottom forms, of small size, occurring in tropical and semitropical marine waters. The meat is sweet and is relished as a delicacy.

This report reviews all forms found in Oceania. The Mullidae of various areas of the Indo-Pacific other than Oceania have been reviewed by several authors, such as the early report by Bleeker (Verh. Akad. Wet. Amsterdam, vol. 15, pp. 1–40, 1875) and the more recent studies by Herre and Montalban (Philippine Journ. Sci., vol. 36, No. 1, pp. 95–136, pls. 1–6, 1928), Weber and de Beaufort (Fishes of the Indo-Australian Archipelago, vol. 6, pp. 361–408, figs. 75–79, 1931) and Fowler (U. S. Nat. Mus. Bull. 100, vol. 12, pp. 258–344, figs. 19–32, 1933). A revision of the genus *Upeneus* was published by Lachner (Proc. U. S. Nat. Mus. vol. 103, No. 3330, pp. 497–532, pls. 13 and 14, 1954). The many closely related but wide ranging species in the family, particularly those in the genus *Parupeneus*, and the incomplete nature of the collections from the area under study, necessitated a review of the species occurring in a broader geographical area. The result is a more reliable appraisal of the species.

Many species show differentiation only in coloration, such as the presence or absence of a spot or color mark, or its shape or location. There are few meristic and other morphological characters that aid in the separation of the species. We thus find, as a result of the numerous closely related species and their great range over the Indo-Pacific area, a confusing nomenclature. Many nominal forms have been described from the various insular and subfaunal areas of this vast region. Progress toward a stable nomenclature can be attained only in an appraisal of all forms in the family, including an evaluation of all types in extant.

The primary characters forming the basis for the natural groups in the family are the differentiation of the dentition and the presence or absence of scales on the soft dorsal, anal, and caudal fins. These differences are tentatively summarized in the key to the genera and in the discussion under the generic accounts. The critical characters most useful in distinguishing the species are given in the keys to the species under each genus and in the discussions in the descriptive accounts of the species. The genera *Upeneus*, *Mulloidichthys*, and *Parupeneus* are reported for the Marianas, but only the latter two were taken in the Marshall Islands. The following tabulation shows the number of species in each genus from the three geographical areas:

	Marshall Islands	Marianas Islands	Oceania
Upeneus	0	1	4 or 5
Mulloidichthys	3	1	4
Parupeneus	5	4	15

The range of the data given for the following characters is common to all species reported herein for Oceania: Dorsal rays VIII–i,8 (*Upeneus* VII or VIII–i,8), anal rays I,i,6; pectoral rays 12 to 18; pelvic rays I,5; caudal rays, upper lobe-lower lobe, i,7+6,1; vertical scale rows 27 to 39; scale rows above lateral line 3, rarely 2; scale rows below lateral line 5 to 7; scale rows around narrowest portion of caudal peduncle 14 to 16 (14 only in *Parupeneus*); total number of gill rakers on first right arch 19 to 42; scales ctenoid, with 4 to 9 radii; lateral line complete.

In order to determine the extent of infraspecific divergence the wide-ranging species were studied from areas other than Oceania when collections were available. The coloration, proportional, and meristic characters were recorded for each species. Wherever the data may be significant or of interest it is tabulated, segregated by locality, and included under the descriptive account of the species. The specimens studied are listed by geographical areas.

In general, there is very little infraspecific differentiation among the wide-ranging species in the numerous, scattered populations from the Red Sea to the Hawaiian Islands. Some divergence on a low racial level is exhibited by several species which differ mainly in the total number of gill rakers.

KEY TO THE GENERA OF MULLIDAE

1*a*. Dentition complete, teeth on vomer, palatines, and on both jaws.
Upeneus Cuvier and Valenciennes

1*b*. Dentition incomplete, the palatines and vomerine teeth, or the palatines, or those of the upper jaw, absent.

2*a*. Upper jaw toothless. Vomer and palatines form a broad palatal patch. **Mullus**[1] Linnaeus

2*b*. Upper jaw with teeth.
  3*a*. No teeth on palatines or vomer.
    4*a*. Teeth in jaws uniserial, large, stout, blunt-tipped, widely spaced, and arranged more or less in a regular row.______**Parupeneus** Bleeker
    4*b*. Teeth of upper jaw almost always in two rows anteriorly, the teeth of the outer row numbering 1 to 3 on each side, curved and directed posteriorly; teeth in lower jaw almost always in two or more rows; teeth stout, blunt-tipped, and rather widely spaced. **Pseudupeneus**[2] Bleeker
    4*c*. Teeth of jaws small, in a villiform band anteriorly. **Mulloidichthys** Whitley
  3*b*. Vomer with a few blunt teeth; none on palatines; jaws with stout, blunt teeth arranged uniserially laterally, and in two or three irregular rows anteriorly________________________**Upeneichthys**[3] Bleeker

Genus UPENEUS Cuvier and Valenciennes

Upeneus Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 3, p. 448, 1829 (type species, *Mullus vittatus* Forskål, designated by Bleeker, Arch. Néerl. Sci. Nat., vol. 11, pt. 2, p. 333, 1876.)

Hypeneus Agassiz, Nomenclatoris zoologici index, p. 190, 1846 (type species, *Mullus vittatus* Forskål, corrected orthography).

Upeneoides Bleeker, Verh. Bataviaasch Gen., p. 64, 1849 (type species, *Mullus vittatus* Forskål, designated by Jordan, Genera of fishes, pt. 2, p. 240, 1919).

This genus is characterized in having the dentition complete, an irregular or triangular patch of small villiform teeth on vomer, an elongate band of such teeth on palatines and in bands of narrow to moderate widths on both jaws. Caudal fin with dark, oblique bars in many species. Body elongate, somewhat compressed, and attaining a small size compared with other members of the family.

Several characters were common to all the species listed in the key below but may not be distinctive generically for they may apply to others in the family: Dorsal spines, VIII-i,8 (also VII-i,8 in three extralimital species), the first spine is minute and likely to be overlooked (see Lachner, Proc. U. S. Nat. Mus., vol. 103, p. 499, 1954); scale rows around caudal peduncle 16; scales ctenoid, with 4 to 7 radii; scales on soft dorsal, anal, and caudal fins; first elongate spine of dorsal fin flexible. Of the 9 species in the genus 4 or possibly 5 are known from Oceania. One species is known from the Hawaiian fauna, *U. arge* Jordan and Evermann, and one, *U. vittatus* (Forskål), from the Marianas Islands but not reported as yet from the Marshall Islands.

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[1] *Mullus* Linnaeus, Systema naturae, ed. 10, p. 299, 1758 (type species, *Mullus barbatus* Linnaeus, designated by Bleeker, Arch. Néerl. Sci. Nat. vol. 11, p. 334, 1876).

This genus is limited to the Atlantic ocean.

[2] *Pseudupeneus* Bleeker, Versl. Akad. Wet. Amsterdam, vol. 14, p. 134, 1862 (type species, *Upeneus prayensis* Cuvier and Valenciennes).

This genus is found in the Atlantic Ocean and in the eastern Pacific waters of the Americas.

[3] *Upeneichthys* Bleeker, Verh. Akad. Wet. Amsterdam, vol. 2, p. 7, 1855 (type species, *Upeneus porosus* Cuvier and Valenciennes).

This genus is represented by several species in the warmer waters of Australia and New Zealand and probably extending into Polynesia.

KEY TO THE SPECIES OF UPENEUS FROM OCEANIA

1*a*. Total number of gillrakers range from 26 to 32; pectoral rays number 15 to 18; peritoneum brown to black.

  2*a*. Caudal fin without dark bars; chin barbels long, 58 to 82 percent of head length in large specimens over 85 mm.; barbel usually extends posteriorly beyond vertical drawn through posteriormost point of preopercle; plate 75,A________**U. sulphureus**[4] Cuvier and Valenciennes

  2*b*. Caudal fin with oblique dark bars on upper lobe; chin barbels short, 46 to 66 percent of head length; barbel when extended posteriorly not reaching vertical drawn through posteriormost point of preopercle.

    3*a*. Lower lobe of caudal fin transparent to dusky, without dark, oblique bars; a pale to yellow median horizontal stripe on side of body, often faintly developed or obscure; plate 75,B.
U. moluccensis[5] (Bleeker)

    3*b*. Lower lobe of caudal fin with 2 or 3 dark oblique bars, the outer bar widest and more intensely colored; a light colored median and dorsolateral, horizontal stripe on body usually present.
U. vittatus (Forskål)

1*b*. Total number of gillrakers range from 19 to 25; pectoral rays number 12 to 15; peritoneum silvery to transparent, sometimes with scattered, fine brownish spots.

  4*a*. Scales smaller, 36 to 38 vertical rows on body; a faint, tan median and dorsolateral horizontal stripe on body, often completely faded; head and body lacking dark spots; tip of spinous dorsal fin without dark spot; plate 75,D_________________**U. arge**[6] Jordan and Evermann

  4*b*. Scales larger, 28 to 32 vertical rows on body; a conspicuous dark brown median stripe on body; head and body with numerous dark brown spots, sometimes faded; outer portion of spinous dorsal fin with a large dark brown to black irregular spot; plate 75,E.
U. tragula[7] Richardson

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[4] *Upeneus sulphureus* Cuvier and Valenciennes, Histoire naturelle des poissons, p. 450, 1829 (type locality, Antjer Straits of Sundra).

Occurs from East Africa through East Indies, Philippines and certain islands of western Oceania (Fiji, Lachner, Proc. U. S. Nat. Mus., vol. 103, p. 513, 1954); New Hebrides, Herre, Field Mus. Nat. Hist. Zool. Series, vol. 21, p. 210, 1936) but not yet known from the Marshall or Marianas Islands.

[5] *Upeneoides moluccensis* Bleeker, Nat. Tijdschr. Nederl.-Indië, vol. 8, p. 409, 1855 (type locality, Amboina).

Reported from India through East Indies-Philippine area, northward to southern Japan and southward to Australia. Lachner (Proc. U. S. Nat. Mus., vol. 103, p. 515, 1954) doubtfully reports it from the Samoan Islands.

[6] *Upeneus arge* Jordan and Evermann, Bull. U. S. Fish. Comm., vol. 22 (1902), p. 187, 1903 (type locality, Honolulu).

Reported from the Hawaiian, Phoenix, Palmyra, Caroline, and Gilbert Islands.

[7] *Upeneus tragula* Richardson, Rep. Fifteenth Meet. British Asso. Adv. Sci., p. 220, 1846 (type locality, Canton).

This species is reported to be common in the western Indo-Pacific. It occurs from East Africa eastward through the Philippines to the Pelew and Solomon Islands, and from southern Japan to New South Wales, Australia.

UPENEUS VITTATUS (Forskål)

PLATE 75,C

Mullus vittatus FORSKÅL, Descriptiones animalium . . ., p. 31, 1775 (type locality, Djedda, Red Sea).—LACEPÈDE, Histoire naturelle des poissons, vol. 3, p. 382, pl. 14, fig. 1, 1802.—SHAW, General zoology, vol. 4, pt. 2, p. 616, pl. 89, 1803.

Mullus bandi SHAW, General zoology, vol. 4, pt. 2, p. 615, 1803 (type locality, Vizagapatam).

Upeneus vittatus CUVIER and VALENCIENNES, Histoire naturelle des poissons, vol. 3, p. 448, 1829.—BLEEKER, Atlas ichthyologique . . ., vol. 9, pl. (2)392, fig. 3, 1877.—FOWLER, U. S. Nat. Mus. Bull. 100, vol. 12, p. 334, fig. 31, 1933; Mem. Bishop Mus., vol. 12, No. 2, suppl. 3, p. 95, 1949.—SMITH, Sea fishes of South Africa, p. 228, pl. 27, fig. 561, 1949.

Upeneus bitaeniatus BENNETT, Proc. Comm. Zool. Soc., vol. 1, p. 59, 1831 (type locality, Mauritius).

Hypeneus vittatus CANTOR, Journ. Asiatic Soc. Bengal, vol. 18, p. 1017, 1850.

Upeneoides vittatus GÜNTHER, Catalogue of the fishes in the British Museum, vol. 1, p. 397, 1859.—DAY, Fishes of India, p. 120, pl. 30, fig. 2, 1878.—SAUVAGE, Histoire naturelle des poissons, *in* Grandidier, Histoire . . . de Madagascar, vol. 16, p. 219 (not pl. 27, fig. 2), 1891.—HERRE and MONTALBAN, Philippine Journ. Sci., vol. 36, No. 1, p. 105, pl. 4, fig. 1, 1928.

Upeneoides caeruleus DAY, Proc. Zool. Soc. London, p. 194, 1868 (type locality, Madras); Fishes of India, p. 121, 1878.

Upeneoides vittatus KLUNZINGER, Verh. Zool.-Bot. Ges. Wien, vol. 20, pt. 1, p. 741, 1870 (error).

Upeneoides philippinus FOWLER, Proc. Acad. Nat. Sci. Philadelphia, vol. 70, p. 37, fig. 15, 1918 (type locality, Philippines).

SPECIMENS STUDIED

Guam: 2 lots, 7 specimens, 74 to 155 mm. in standard length.

In addition 50 lots totaling 143 specimens were studied from Zanzibar, East Africa, eastward through the Philippines to the Low Archipelago and Marquesas Islands (see Lachner, Proc. U. S. Nat. Mus., vol. 103, p. 516, 1954).

Description.—The following counts and measurements were taken from the seven specimens from Guam. Dorsal rays VIII-i,8, the first spine minute; pectoral rays ii,14 to ii,15; vertical scale rows 34 to 36; scale rows above lateral line 3; scale rows below lateral line 7; total number of gillrakers 27 to 29; length of longest raker in longest filament averages about 1.2.

Peritoneum dark brown to silvery brown; preorbital scales absent; barbels extend beyond eye but not beyond preopercular margin; barbel length in percent of head length 51 to 58; third dorsal spine equal to or slightly greater than second.

Color in alcohol.—Head and body light tan to golden tan, darker above and lighter tan to silvery below; two or three faint, dark horizontal stripes dorsolaterally above middle of body.

Spinous dorsal fin with two blackish horizontal bars, one on outer and one near middle of fin; outer bar passes through outer third of second to fifth spines, and is colored an intense black; a whitish bar between the two black bars; soft dorsal with three dusky to black bars, a short one near the posterior basal area, a long horizontal bar at middle of fin and a narrow dusky tip on the first to third rays; caudal fin with oblique, dusky to black bars, 3 or 4 on the upper lobe and 2 or 3 on the lower; tip of longest (outer) rays of the upper lobe are slightly touched in black; outer bar on lower lobe with more intense black and twice as wide as other bars on caudal; this particular bar never at tip of lower lobe; two, nearly horizontal bars extend from area near fork of caudal fin to areas just above and below mid-base of fin; pectorals, pelvics and anal fins transparent.

Range.—From the Red Sea, East Indies and Philippines eastward in the islands of Oceania to the Low Archipelago, and from Japan southward to Australia but not reported from the Hawaiian Islands.

Genus PARUPENEUS BLEEKER

Parupeneus Bleeker, Versl. Akad. Wet. Amsterdam, vol. 2, p. 344, 1868 (type species, *Mullus bifasciatus* Lacepède).

Dentition incomplete; teeth in the jaws uniserial, stout, blunt-tipped and widely spaced, arranged in a more or less regular row; no vomer or palatine teeth; scales around narrow portion of caudal peduncle 14.

The following characters were common to all species of *Parupeneus* and may apply to some of the other genera in the family: Scales on caudal fin, absent on dorsal and anal fins; dorsal fin rays VIII-i,8, the first spine small; pectoral rays 14 to 18; scales above lateral line 3; scales below lateral line 5 to 7; second dorsal spine (first elongate spine) of spinous dorsal fin either flexible or rigid near tip.

This genus inhabits the warm littoral marine waters of the Indo-Pacific region from the African east coast eastward to Easter Island. It is absent in the Atlantic fauna and the eastern Pacific region of the Americas. Five species were taken in the Marshall Islands and four from the Marianas. There are probably more than 15 species in the area of Oceania.

The following specimens of *Parupeneus*, representing at least three species almost all taken at night, were not specifically identified, as the coloration typical of the adults was not developed:

Bikini Atoll: 8 stations, 368 specimens, 20 to 59 mm.
Eniwetok Atoll: 4 stations, 149 specimens, 21 to 55 mm.
Rongelap Atoll: 2 stations, 158 specimens, 33 to 58 mm.
Rongerik Atoll: 1 station, 5 specimens, 32 to 35 mm.

The critical characters useful in distinguishing the species of *Parupeneus* occurring in Oceania are given in the key. Several of the meristic and proportional characters are summarized and tabulated in tables 59 through 62. Several characters differ in their increase rate of development with increase in body length, notably the length of the head, barbel, and snout. A regressive development occurs in the diameter of the eye; it decreases with an increase in body length. These regressions are shown in the frequency distributions in the descriptive accounts of the species *P. barberinus*, tables 65 and 67; *P. bifasciatus*, tables 69 and 70; *P. trifasciatus*, tables 72 and 73; *P. pleurostigma*, tables 74 and 75; and *P. cyclostomus*, table 77. This difference in rate of development has lead to much of the confusion in species recognition. Many of the nominal forms are size variants, the very large specimens of several species look, superfically, totally unlike their respective subadults.

TABLE 59.—*Number of gill rakers in species of* Parupeneus *from various Indo-Pacific localities*

Species	Total number of gill rakers																		
	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
barberinus	----	----	1	14	31	17	12	7	----	----	----	----	----	----	----	----	----	----	----
pleurotaenia	----	----	----	----	----	1	3	1	----	----	----	----	----	----	----	----	----	----	----
orientalis	----	----	----	----	----	----	----	----	----	----	----	----	1	----	----	----	----	----	----
macronemus	----	----	----	----	----	----	----	3	4	1	----	----	----	----	----	----	----	----	----
bifasciatus	----	----	----	----	----	----	----	----	----	----	1	8	12	16	12	4	2	1	----
multifasciatus	----	----	----	----	----	----	----	----	----	----	----	----	----	2	5	10	6	----	1
trifasciatus	----	----	----	----	----	----	----	----	----	----	----	3	9	23	19	27	28	11	4
barberinoides	----	----	----	1	3	8	1	1	----	----	----	----	----	----	----	----	----	----	----
pleurostigma	----	----	----	----	2	6	10	8	1	----	----	----	----	----	----	----	----	----	----
indicus	2	3	15	10	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
cyclostomus	----	----	----	1	3	5	17	17	3	----	----	----	----	----	----	----	----	----	----
luteus	----	----	----	2	2	1	----	----	----	----	----	----	----	----	----	----	----	----	----
porphyreus	----	----	----	----	----	----	----	9	6	11	1	----	----	----	----	----	----	----	----
chrysonemus	----	----	----	----	----	----	----	----	1	1	4	3	----	----	----	----	----	----	----
crassilabris	----	----	----	----	----	----	----	----	----	----	----	----	----	1	----	1	----	----	----

TABLE 60.—*Total number of pectoral fin rays in species of* Parupeneus *from various Indo-Pacific localities*

Species	Pectoral fin rays				
	14	15	16	17	18
barberinus	----------	----------	1	15	15
pleurotaenia	----------	1	4	----------	----------
orientalis	----------	----------	1	----------	----------
macronemus	----------	3	5	----------	----------
bifasciatus	----------	4	25	----------	----------
multifasciatus	----------	1	13	2	----------
trifasciatus	----------	5	23	----------	----------
barberinoides	----------	13	1	----------	----------
pleurostigma	----------	2	14	2	----------
indicus	----------	2	17	----------	----------
cyclostomus	----------	----------	26	3	----------
luteus	----------	----------	5	----------	----------
porphyreus	2	41	1	----------	----------
chrysonemus	----------	2	10	----------	----------
crassilabris	----------	----------	1	1	----------

Table 61.—*Length of head and barbel as a percentage of standard length in species of* Parupeneus *from various Indo-Pacific localities*

Species	Head												Barbel											
	28	29	30	31	32	33	34	35	36	37	38	39	14–15	16–17	18–19	202–1	22–23	24–25	26–27	28–29	30–31	32–33	34–35	36–37
barberinus				2	2	6	10	13	7	3	1	1			3	8	18	12	2					
pleurotaenia				2	3											1	4							
orientalis									1								1							
macronemus			1	1	3	2	1								4	2	1		1					
bifasciatus			1	4	15	12	11	2					1	9	13	14	8							
multifasciatus					1	4	5	3	1										6	7		1		
trifasciatus			1	1	8	12	11	5		1	1					5		8	16	8	5			
barberinoides					1		2	2		2							2	2	1	2				
pleurostigma	1	7		2	3	5	12	3					2	4	2	10	11	2	1					
indicus				4	8	6	4	2	1							1	14	10						
cyclostomus					1	8	9	9	6	2								1	1	6	15	7	2	1

TABLE 62.—*Diameter of eye and length of snout as a percentage of standard length in species of* Parupeneus *from various Indo-Pacific localities*

Species	Eye								Snout													
	4	5	6	7	8	9	1	11	10	11	12	13	14	15	16	17	18	19	20	21	22	23
barberinus	------	------	15	9	16	5	1	------	1	3	2	1	------	2	4	7	12	8	3	2	------	1
pleurotaenia	------	------	------	4	------	1	------	------	------	------	------	------	1	------	3	1	------	------	------	------	------	------
orientalis	------	------	1	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	1	------	------
macronemus	------	------	4	4	------	------	------	------	------	------	------	------	------	------	2	2	3	1	------	------	------	------
bifasciatus	------	------	1	21	14	9	------	------	------	------	------	------	2	6	9	12	11	3	2	------	------	------
multifasciatus	------	1	8	4	1	------	------	------	------	------	------	------	------	------	------	------	4	8	2	------	------	------
trifasciatus	------	1	18	8	12	2	------	------	------	3	1	------	------	------	9	6	11	10	1	1	------	------
barberinoides	------	------	2	4	------	1	------	------	------	------	------	------	------	------	------	------	1	3	3	------	------	------
pleurostigma	------	1	4	14	8	1	------	------	5	4	------	------	------	3	2	3	10	5	------	1	------	------
indicus	------	1	10	7	7	1	------	------	------	------	------	1	1	4	4	3	6	3	3	------	------	------
cyclostomus	1	9	12	8	5	------	------	------	------	------	------	2	------	1	3	7	6	9	7	------	------	------

Populational divergence on a racial level is evident in three wide-ranging species, *P. cyclostomus*, *P. trifasciatus*, and *P. bifasciatus.* The East Indies and Philippine populations of these species have a lower number of gill rakers than specimens from Oceania (see tables 68, 71, and 78 in descriptive accounts). No other meristic, proportional or color character showed any perceptible divergence in the various subfaunal areas of the Indo-Pacific region, but larger and more adequately distributed collections are needed for many of the species.

KEY TO SPECIES OF PARUPENEUS FROM OCEANIA, INCLUDING CLOSELY RELATED EXTRALIMITAL FORMS

1*a*. Body with dark or light horizontal stripes; total number of gill rakers range from 26 to 36, fewer than 34 in all but one species.

2*a*. Peritoneum dark brown to black; second dorsal spine flexible near tip, not pungent; gill rakers range from 26 to 31; a conspicuous, black horizontal stripe passing from snout through eye, on dorsolateral portion of body, and ending on upper portion of caudal peduncle; a large, circular black spot at base of caudal fin, its diameter more than ¾ that of eye, with the lateral line passing nearly through its center. **P. barberinus** (Lacepède)

2*b*. Peritoneum pale, light to silvery.

3*a*. Second dorsal spine flexible near tip in the adults, not pungent; gill rakers fewer, range from 29 to 31; barbel of average length, extending to margin of preopercle; a median and a dorsolateral light stripe on body; a light or pale saddle posterior to dorsal fin, followed by a dark brown saddle, which is occasionally divided into two dorsolateral spots; body depth in standard length about 3.1 to 3.3 in adults-------------------------**P. pleurotaenia**[8] (Playfair)

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[8] *Mullus pleurotaenia* Playfair, *in* Playfair and Günther, Fishes of Zanzibar, p. 41, pl. 5, fig. 3 (not fig. 4), 1866 (type locality, Zanzibar).

Mullus dispilurus Playfair, *in* Playfair and Günther, Fishes of Zanzibar, p. 41, pl. 5, fig. 4 (not fig. 3), 1866 type locality, Zanzibar, Island of Pemba) (questionable allocation).

Upeneus dispilurus Day, Fishes of India, p. 125, pl. 31, fig. 3, 1878 (questionable allocation).

Pseudupeneus fraterculus Fowler, U. S. Nat. Mus. Bull. 100, vol. 12, p. 302, fig. 25, 1933.

Five specimens (USNM 138602 to 138605 and 138651, *Albatross*) taken at Cataingan Bay and Jolo Market, Philippine Islands, were examined.

The nomenclatorial problems concerning this species are complicated, and the application of *Mullus pleurotaenia* Playfair, is tentative. Playfair (1866) confused his descriptions of *pleurotaenia* and *dispilurus* with his figures, probably by assigning the incorrect figure numbers. Day (1878) examined Playfair's types and remarked that faint light horizontal stripes were visible on *dispilurus* as well as *pleurotaenia.* On the strength of Day's observation I have placed *Mullus dispilurus* Playfair in the above synonymy, but as a questionable allocation. The color description that Day gave for his specimens from "Sind," such as the small spots on the scales and the absence of light horizontal stripes, suggests that he had still another species.

Sauvage (Histoire naturelle des poissons, *in* Grandidier, Histoire . . . de Madagascar, vol. 16, p. 225, pl. 27, fig. 3, 1891) placed *Mullus pleurotaenia* Playfair in the synonymy of *Upeneus fraterculus* Cuvier and Valenciennes (Histoire naturelle des poissons, vol. 7, p. 524, 1831, type locality, Mahé Island, Seychelles Island, Indian Ocean) and Fowler (U. S. Nat. Mus. Bull. 100, vol. 12, p. 302, fig. 25, 1933) followed this procedure. However Sauvage's figure 3 shows 2 dark dorsal saddles on the body which is totally unlike the species in question. His figure closely resembles *P. bifasciatus* (Lacepède). Fowler's figure 25 is fairly characteristic of our specimens. The collections listed above represent those reported on by Fowler from Cataingan Bay and Jolo Market. The inclusion of *Upeneus fraterculus* Sauvage in the synonymy of *P. fraterculus* by Fowler is certainly erroneous. Further, there is no validity in applying the name *Upeneus fraterculus* Cuvier and Valenciennes to our specimens, as no evidence is presented by them that their specimens possessed light stripes on the body.

Pseudupeneus ischyrus Snyder (Proc. U. S. Nat. Mus., vol. 32, p. 90, fig. 2, 1907, type locality, Tokyo, Japan) may also represent this species. Snyder's specimen was undoubtedly considerably faded for he indicates and illustrates remanents of a dark and light dorsolateral body stripe.

3*b*. Second dorsal spine not flexible, pungent; gill rakers numerous, 36; barbel short, almost extends to posterior margin of eye; 8 or 9 narrow dark horizontal stripes on body; light post-dorsal fin saddle very faint; body deep, depth in standard length about 2.6 in adults; faint traces of 5 dark dorsal blotches on body; plate 78,E--**P. orientalis**[9] (Fowler)

3*c*. Second dorsal spine flexible near tip, not pungent; gill rakers range from 31 to 33; barbel of average length, extends beyond posterior margin of eye, almost reaching margin of preopercle; a conspicuous black horizontal stripe from snout through eye to dorsolateral portion of caudal peduncle; a distinct round spot dorsolaterally on caudal peduncle, about ½ diameter of eye, the lateral line just touching its lower margin; a light, post-dorsal fin saddle sometimes visible, followed by a small faint brown saddle; body depth in standard length about 3.4 to 3.8 in adults----**P. macronemus**[10] (Lacepède)

1*b*. Body with wide, moderate to intensely developed, dark vertical bands or saddlelike bars, sometimes encircling body; gill rakers numerous, range from 34 to 42.

4*a*. Three widely spaced blackish transverse bands over dorsal portion of body and extending ventrally to belly but not encircling it; anterior band extends from about the anterior half of the base of the spinous dorsal fin, middle band passes through base of soft dorsal fin, and posterior band passes over caudal peduncle just anterior to procurrent rays of caudal fin--------------------------------**P. bifasciatus** (Lacepède)

4*b*. Four blackish transverse bands nearly encircling the body; first, and anteriormost, widest, passes over body dorsally between occiput and origin of spinous dorsal fin and extends ventrally through base of pectoral fin; second is separated from third by a scale or two and passes between the spinous and soft dorsal fins; third passes through anterior half of soft

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[9] *Pseudupeneus orientalis* Fowler, U. S. Nat. Mus. Bull. 100, vol. 12, p. 294, fig. 23, 1933 (type locality, Cooks Bay, Easter Island).

Pseudupeneus multifasciatus Kendall and Goldsborough, Mem. Mus. Comp. Zool., vol. 35, p. 122, 1912 (based on holotype of *P. orientalis*).

Upeneus multifasciatus Fowler, Mem. Bishop Mus., vol. 19, p. 228, 1928 (that portion based on Kendall and Goldsborough, 1912).

This species is known by the holotype, USNM 65639, taken by the *Albatross* at Cooks Bay, Easter Island.

[10] *Mullus macronemus* Lacepède, Histoire naturelle des poissons, vol. 3, pp. 383 and 404, 1802 (type locality not given).

Mullus auriflamma Lacepède, Histoire naturelle des poissons, vol. 3, p. 400, 1802.

Upeneus lateristriga Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 3, p. 463, 1829.

Upeneus lateristriata Valenciennes, *in* Cuvier, Règene animal . . ., ed. 4, page opp. pl. 19, 1836. (spelling error).

Upeneus lateristriga Valenciennes, *in* Cuvier, Règne animal . . ., ed. 4, pl. 19, fig. 3, 1836.

Parupeneus macronema Bleeker, Verh. Akad. Wet. Amsterdam, p. 24, 1875; Atlas ichthyologique . . ., vol. 9, pl. 391, fig. 3, 1878.

Apogon amherstinus Day, Fishes of India, pt. 1, p. 124, 1878 (a manuscript name; = *barberinus*?).

Eight specimens (USNM 47602, 49329, 147537, and 147538) from the Red Sea were examined.

Although this species has been reported from the Red Sea to the Hawaiian Islands, I cast doubt on its presence east of the East Indies and Philippine Islands. Fowler (Copeia, No. 112, p. 83, 1922) merely listed it from Hawaii. No one has since reported on this material. Poorly preserved specimens of this species may easily be confused with *P. barberinus*. Vaillant (Bull. Soc. Philomath., Paris, ser. 7, vol. 11, p. 59, 1866) reported *macronemus* from Tahiti, but his description is also inadequate and he may have had one of several species.

Day's (1878, p. 124, pl. 31, fig. 1) description and illustration of *macronemus* lacks the necessary details to determine with assurance what he had. His fig. 1 resembles *barberinus* not *macronemus*. His confusion is illustrated by his statement, "The similarity between this species [*barberinus*] and *U. macronemus* is so great that I have not considered it necessary to figure both." Thus, *Apogon amherstinus* on his page 124, probably a manuscript name of Blyth's, may either represent *macronemus* or *barberinus*.

dorsal fin; fourth band or saddlelike mark, is present just before base of caudal fin, passing dorsally over peduncle; plate 77,B.
P. multifasciatus[11] (Quoy and Gaimard)

4*c*. Five black, transverse bands over dorsal portion of body and extending ventrally to area of belly but not encircling it; first is located just anterior to spinous dorsal fin; second, wider than first, passes through middle of spinous dorsal fin; third passes between spinous and soft dorsal fins, and is the narrowest; fourth more intensely black than those anterior to it, passes through anterior portion (5 anterior rays) of soft dorsal fin; fifth band passes over caudal peduncle just before base of caudal fin------------------------------**P. trifasciatus** (Lacepède

1*c*. Body with a large (larger than several scales) conspicuous dark or (and) light spot, or patchlike mark, on side; gill rakers range from 24 to 32.

5*a*. Gill rakers more numerous, total from 27 to 32; peritoneum light, transparent or slightly silvery.

6*a*. Side of body with a very large, somewhat rectangular, patchlike dark mark extending from end of head to a vertical drawn ventrally from origin of soft dorsal fin, where it abruptly ends; a small spot or W-shaped mark about the size of the eye on caudal peduncle just above lateral line and below area posterior of soft dorsal fin; barbel longer, extending beyond posterior margin of preopercle; pectoral rays usually 15 (table 60); plate 77,D----**P. barberinoides**[12] (Bleeker)

6*b*. Side of body below end of spinous dorsal fin with a black, somehwat circular, spot about 4 scale rows in diameter; this black spot followed posteriorly by an elongate oval light spot below and slightly anterior to base of soft dorsal fin, its horizontal length about equal to length of base of soft dorsal fin; barbel shorter, not extending to posterior margin of preopercle; pectoral rays usually 16 (table 60).
P. pleurostigma (Bennett)

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[11] *Mullus multifasciatus* Quoy and Gaimard, Voyage autour du monde . . . sur, . . . l'*Uranie* et la *Physicienne*, Zoologie, p. 330, pl. 59, fig. 1, 1824 (type locality, Hawaiian Islands).

Parupeneus bifasciatus Weber and de Beaufort, Fishes of the Indo-Australian Archipelago, vol. 6, p. 386, 1931 (in part).

Pseudupeneus multifasciatus Jordan and Evermann, Bull. U. S. Fish Comm., vol. 23, 1903, part 1, p. 256, pl. 22, 1905.—Fowler, U. S. Nat. Mus. Bull. 100, vol. 12, p. 300, 1933.

Upeneus velifer Smith and Swain, Proc. U. S. Nat. Mus., vol. 5, p. 130, 1883 (type locality, Johnston Island).

Nine lots, totaling 28 specimens, from the Hawaiian Islands and 2 specimens (USNM 26822, type of *Upeneus velifer*, and 157360) from Johnston Island were studied.

This species is apparently confined to the Hawaiian and Johnston Islands. The various authors that distinguished *trifasciatus* and *bifasciatus* from *multifasciatus* also report the latter species only from these Islands. Fowler (Acad. Nat. Sci. Philadelphia, Monogr. 2, p. 284, 1938) listed it from Tahiti, Society Islands, but gives no specific data or source of material (one specimen, *Parupeneus trifasciatus*, USNM 82966 taken at Tahiti by the Wilkes exploring expedition was misidentified as *multifasciatus* previous to this report).

P. multifasciatus appears to replace almost completely *trifasciatus* and *bifasciatus* in the Johnston and Hawaiian fauna (see discussion of range under *trifasciatus* and *bifasciatus*).

It does not seem logical to apply any other name to this species, in view of its restricted distribution, especially when it is compared with such closely related forms, *trifasciatus* and *bifasciatus*. However, the figure of *multifasciatus* by Quoy and Gaimard is crude and their description is incomplete.

[12] *Upeneus barberinoides* Bleeker, Nat. Tijdschr. Nederl.-Indië, vol. 3, p. 263, 1852 (type locality, Wahai, northern Ceram).—Herre and Montalban, Philippine Journ. Sci., vol. 36, No. 1, p. 120, pl. 4, fig. 3, 1928.

Parupeneus barberinoides Bleeker, Nederl. Tijdschr. Dierk., vol. 1, p. 234, 1863; Atlas ichthyologique . . . vol. 9, pl. (2) 392, fig. 5, 1877.

Pseudupeneus barberinoides Fowler, U. S. Nat. Mus. Bull. 100, vol. 12, p. 276, fig. 20, 1933.

Thirteen lots were examined: Philippine Islands, USNM 138639 to 138649, 22 specimens, *Albatross;* Okinawa, USNM 71734, 2 specimens, *Albatross;* Tonga Islands, USNM 65995, 3 specimens, *Albatross.*

This species has been reported from the East Indies, Philippines, southern Ryukyu Islands and several Island groups of Oceania.

5*b*. Gill rakers fewer, total from 24 to 27; peritoneum dark brown in adults, silvery brown in small specimens; a light oval spot about 7 scale rows in length below end of soft dorsal fin, the lateral line passing through its lower portion; a distinct circular black spot on caudal peduncle anterior to caudal fin and more of it above lateral line than below, and its diameter greater than orbit; barbel long, extending beyond posterior margin of preopercle; plate 76,A_______________**P. indicus** [13] (Shaw)

1*d*. Sides of body chiefly plain, lacking conspicuous stripes, bands, spots or marks; at most, scales may have small light spots or the caudal peduncle may have a light or dark saddle (weak dark saddles through the dorsal fins present in one species); gill rakers, range from 27 to 39.

7*a*. Second dorsal spine flexible near tip, not pungent; gill rakers fewer, range from 27 to 32; barbels long, extending beyond posterior margin of preopercle.

8*a*. Scales lacking light circular spots; a prominent light spot dorsally on caudal peduncle posterior to soft dorsal fin, its length more than twice diameter of eye (spot present in about 50 percent of specimens, faded in others); head longer, 32 to 37 percent of standard length; barbels very long, extending to posterior margin of head; snout longer and pointed, eye smaller, eye in snout 2.2 to 5.1 in specimens larger than 75 mm__________**P. cyclostomus** (Lacepède)

8*b*. Scales on the body with a light circular spot, slightly smaller than pupil, these forming about 5 faint horizontal rows; light spot on caudal peduncle absent; head shorter, about 30 to 32 percent of standard length; barbels shorter, not extending to end of head; snout shorter

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[13] *Mullus indicus* Shaw, General zoology, vol. 4, pt. 2, p. 614 (type locality, Indian Seas) (on *Rahtee goolivinda* Russell, . . . Fishes collected at Vizagapatam on the coast of Coromandel, vol. 2, p. 42, pl. 157, 1803, Vizagapatam).

Upeneus indicus Gunther, Catalogue of the fishes in the British Museum . . . . vol. 1, p. 406, 1859.—Day, Fishes of Malabar, p. 28, 1865; Fishes of India, pt. 1, p. 126, pl. 31, fig. 4, 1875.—Herre and Montalban, Philippine Journ. Sci., vol. 36, No. 1, p. 115, pl. 2, fig. 1, 1928.

Parupeneus indicus Bleeker, Verh. Akad. Wet. Amsterdam, vol. 15, p. 27, 1875; Atlas ichthyologique . . . , vol. 9, pl. 394, fig. 5, 1878.—Barnard, Ann. South African Mus., vol. 21, pt. 2, p. 589, 1927.—Weber and de Beaufort, Fishes of the Indo-Australian Archipelago, vol. 6, p. 394, 1931.

Pseudupeneus indicus Fowler, U. S. Nat. Bull. 100, vol. 12, p. 287, fig. 22, 1933.—Smith, Sea fishes of southern Africa, p. 230, pl. 27, fig. 567, 1949.

Upeneus russelli Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 3, p. 465, 1829 (on *Rahtee goolivinda* Russell, 1803).

Upeneus waigiensis Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 3, p. 466, 1829.

Upeneus malabaricus Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 3, p. 467, 1829 (type locality, Malabar).

Parupeneus malabaricus Weber and de Beaufort, Fishes of the Indo-Australian Archipelago, vol. 6, p. 395, 1931.—Schultz, U. S. Nat. Mus. Bull. 180, p. 130, 1943.

Upeneus griseofrenatus Kner, Sitzb. Akad. Wiss. Wien, vol. 58, pt. 1, p. 305, pl. 3, fig. 7, 1868 (type locality, Fiji).

The following 32 USNM lots totaling 55 specimens were examined: East Indies, 1 specimen; Philippines, 23 lots, 40 specimens; China, 1 specimen; Japan and Okinawa, 3 lots, 4 specimens; New Guinea, 1 specimen; Admiralty Islands, 1 lot, 4 specimens; Fiji Islands, 1 specimen; Samoa, 1 lot, 3 specimens.

This species is widely distributed from the east African coast eastward to islands of Oceania.

An examination of the coloration, size, and location of the light body spot and dark caudal spot, meristic characters (tables 59 and 60), and body proportions (tables 61 and 62), did not indicate that more than one species may be present in our material. Such differences as the location of the eye and length of snout and barbel considered by Weber and de Beaufort (Fishes of the Indo-Australian Archipelago, vol. 6, p. 397, 1931) to distinguish between *indicus* and *malabaricus* can be attributed to individual variation or differences in stages of development, a condition exhibited in most of the species of *Parupeneus*. Alcoholic specimens 40 to 50 mm. in length have developed the adult coloration, but the eye is larger and the snout considerably shorter than in larger specimens. An inspection of the data in table 63, as well as the data for other species, reveals that as the body increases in length, the eye proportionately decreases in size and the snout increases, thereby considerably altering the position of the eye in respect to head length.

Table 63.—*Length of head, barbel, and snout, and diameter of eye, as a percentage of standard length in* Parupeneus indicus *from various Indo-Pacific localities, segregated by size groups*

Standard length in mm.	Head						Barbel					Eye					Snout							
	31	32	33	34	35	36	21	22	23	24	25	5	6	7	8	9	13	14	15	16	17	18	19	20
40–59	1	1		1	1			2		1	1				3	1	1	1	1	1				
60–79		1	2	1				1	2	1				1	3				2	1	1			
80–99	1	2					1	1	1					3					1	1	1			
100–119			1		1	1					3			2	1							2	1	
120–139																								
140–159	1	1						1		1			2							1		1		
160–179		1		1				1	1				2									1	1	
180–199	1		2	1				2	2		1		4	1							1		2	2
200–219			1							1			1									1		
220–239																								
240–259		2								1	1	1	1									1		1

TABLE 64.—*Total number of gill rakers in* Parupeneus indicus, *by locality*

Locality	Gill rakers			
	24	25	26	27
East Indies			1	
Philippines	1	2	8	6
China				1
Japan-Okinawa	1		3	
Admiralty		1	2	1
Fiji			1	
Samoa				2

and rounded, eye larger, eye in snout 1.9 to 2.4 in specimens larger than 87 mm.; plate 76,C----**P. luteus**[14] (Cuvier and Valenciennes)

7*b*. Second dorsal spine not flexible near tip, pungent; gill rakers intermediate in number, ranging from 31 to 35; barbels either short, extending to about the posterior margin of eye, or long, nearly reaching end of head.

9*a*. Barbels shorter, extending to posterior margin of eye or slightly beyond; pectoral rays almost always 15 (table 60); a light spot or saddle on caudal peduncle just posterior to soft dorsal fin, slightly larger than eye; light spot partially or completely divided into halves along the dorsal midline in some specimens; a dark saddle usually posterior of light spot; three weak bars through dorsal fins in some specimens; a faint dark stripe through eye, faded on body; a small dark spot just behind eye; body coloration generally pale or dusky.
P. porphyreus[15] (Jenkins)

9*b*. Barbels longer, extending clearly beyond posterior margin of preopercle, nearly reaching end of head; pectoral rays usually 16 (table 60); a light area dorsally on caudal peduncle followed by a faint to moderately developed dark saddle; head and body otherwise uniformly light golden or pale; plate 76,D.
P. chrysonemus[16] (Jordan and Evermann)

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[14] *Upeneus luteus* Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 7, p. 521, 1831 (type locality, Mauritius).—Day, Fishes of India, p. 125, pl. 31, fig. 2, 1878.—Herre and Montalban, Philippine Journ. Sci., vol. 36, No. 1, p. 114, pl. 5, fig. 1, 1928.

Mullus luteus Playfair, *in* Playfair and Günther, Fishes of Zanzibar, p. 41, 1866.

Parupeneus luteus Bleeker, Verh. Akad. Wet. Amsterdam, vol. 15, No. 3, p. 32, 1875; Atlas ichthyologique . . . , vol. 9, pl. (4) 394, fig. 1, 1878.—Weber and de Beaufort, Fishes of the Indo-Australian Archipelago, vol. 6, p. 401, 1931.

Pseudupeneus luteus Fowler, U. S. Nat. Mus. Bull. 100, vol. 12, p. 313, 1933.

Five specimens (USNM 138599 to 138601) from the Philippine Islands were examined: This species has been reported from the east African Coast to the Philippines and New Guinea. I have seen no specimens or convincing records of its occurrence in Oceania.

[15] *Pseudupeneus porphyreus* Jenkins, Bull. U. S. Fish Comm., vol. 22, p. 454, fig. 22, 1903, (type locality, Honolulu, holotype, USNM 50705, examined).—Jordan and Evermann, Bull. U. S. Fish Comm., vol. 23, pt. 1, p. 262, fig. 110, 1905.—Fowler, U. S. Nat. Mus. Bull. 100, vol. 12, p. 310, fig. 26, 1933.

Upeneus porphyreus Fowler, Mem. Bishop, Mus., vol. 10, p. 228, pl. 20,A, 1928

Fourteen lots, totaling 72 specimens, from the Hawaiian Islands were examined.

This species may be endemic to the Hawaiian Islands.

[16] *Pseudupeneus chrysonemus* Jordan and Evermann, Bull. U. S. Fish. Comm., vol. 22, p. 186, 1903 (type locality, Hilo; Honolulu; 6 cotypes, USNM 50676, 126548–9, were examined).—Jordan and Evermann, Bull. U. S. Fish. Comm., vol. 23, pt. 1, p. 258, pl. 21, 1905.—Fowler, U. S. Nat. Mus. Bull. 100, vol. 12, p. 312, 1933.

Upeneus chrysonemus Fowler, Proc. Acad. Nat. Sci. Philadelphia, p. 648, 1930.

Upeneus taeniatus Fowler, Mem. Bishop Mus., vol. 10, p. 229, 1928 (based on type).

Ten lots (USNM 126548, 126549, 50676), totaling 12 specimens, from the Hawaiian Islands were studied. This species appears to be restricted to the Hawaiian Islands.

7*c*. Second dorsal spine not flexible near tip, pungent; gill rakers numerous, about 37 to 39; barbels intermediate in length, extending to posterior margin of preopercle; body pale, margins of fins dusky, soft dorsal and anal with dark spots on basal half, with about 4 faint narrow, dark bars on outer portion______**P. crassilabris** (Cuvier and Valenciennes)

PARAPENEUS BARBERINUS (Lacepède)

Plate 78,D

Mullus barberinus Lacepède, Histoire naturelle des poissons, vol. 3, p. 406, pl. 13, fig. 3, 1802 (type locality, near Moluccas).

SPECIMENS STUDIED

Bikini Atoll: 6 stations, 22 specimens, 32 to 175 mm. in standard length.
Eniwetok Atoll: 2 stations, 3 specimens, 34 to 169 mm.
Rongelap Atoll: 3 stations, 5 specimens, 66 to 109 mm.
Rongerik Atoll: 1 specimen, 162 mm.
Kwajalein Atoll: 1 specimen, 132 mm.
Guam: 3 lots, 24 specimens, 37 to 146 mm.

In addition 54 lots totaling 153 specimens were examined from: East Indies and Philippines, 41 lots, 124 specimens; Okinawa, 2 lots, 2 specimens; Caroline Islands, 2 lots, 12 specimens; New Guinea, 1 specimen; Solomon Islands, 2 lots, 3 specimens; Gilbert Islands, 1 specimen; Samoan Islands, 1 specimen; Admiralty Islands, 1 lot, 7 specimens; Tuamotu Islands, 1 specimen; Pacific Ocean, 2 lots, 2 specimens (Wilkes exploring expedition).

Description.—The following counts and measurements were taken from 8 of the specimens from Bikini Atoll, 65 to 144 mm. in standard length (other counts and measurements in tables 65–67): Dorsal rays VIII-i,8; anal rays I,i,6; pectoral rays ii,14 to 16 (30 specimens); vertical scale rows 28 to 29; scale rows above lateral line 3, below lateral line 6.

Body depth 3.5; head length 2.8 to 3.0; length of caudal peduncle 3.6 to 4.1; length of longest pectoral ray 4.1 to 4.7; all in standard length. Eye 4.6 to 5.5; length of upper jaw 3.0 to 3.4; depth of caudal peduncle 2.5 to 3.2; length of snout 1.8 to 2.2; length of barbel 1.4; all in length of head. Eye in snout 2.4 to 3.3 Gill rakers, including rudiments, 6 or 7+1+20 or 21, total (39 specimens) 27 to 29, longest raker about two-thirds longest filament, 2 to 2.3 in eye.

Teeth of upper and lower jaws stout, blunt tipped, and in a single row; no teeth on vomer or palatines; small scales on caudal fin, absent on dorsal and anal fins; cheek and opercle scaled; barbels reach vertical drawn touching posterior edge of preopercle; first dorsal spine minute, second spine about nine-tenths length of third spine; tip of second spine of spinous dorsal flexible in adults; peritoneum dark brown to black; scales ctenoid, with about 4 to 8 radii on the anterior field.

Color in alcohol.—Head and body light or whitish on cheeks, opercles, and area on body below horizontal stripe, but the scales in some specimens are bordered in dusky; dorsal portion of snout, head, and body above horizontal stripe light tan to dusky tan; a blackish horizontal stripe faintly developed from tip of snout, on each side, to eye, well developed from eye through anterior portion of lateral line and extending to upper portion of caudal peduncle, where it ends just beyond soft dorsal fin; width of horizontal stripe about two-thirds diameter of eye; a large, circular, black caudal spot, located at midbase of caudal fin; the posterior margin of spot reaching end of hypural; lateral line passing through middle of spot; some dusky pigment on midportion of membrane of soft dorsal fin, forming a faint horizontal streak; some dusky pigment on membrane of spiny dorsal fin; remainder of fins transparent.

Color in life.—The following color notes were taken from a Kodachrome transparency of a specimen about 12 inches in total length, loaned to the writer by Dr. Donald Strasburg, U. S. Fish and Wildlife Service, Honolulu, Hawaii. Head and body light silvery; lips and lower cheeks orange; black stripe from snout through eye dorsolaterally to area below middle of soft dorsal; area above black dorsolateral stripe yellowish; a black basicaudal spot; spinous dorsal fin bluish-orange near base, bluish outer portion; soft dorsal fin light bluish; base of pectoral fin rose; pectoral fin transparent; pelvic fins light orange; anal fin light dusky to blue; caudal fin light blue; barbels pale blue; iris orange to light silvery.

Range.—This species is widely distributed. Our material extends from the East Indies to the Low Archipelago, but it has been reported frequently in the literature from the Red Sea eastward to the Hawaiian Islands.

Remarks.—No measurable differentiation was found in populations from several major island groups of the Indo-Pacific region.

Interesting and important phenomena in the morphology of this species are the change and rate of change in length of the head, barbel, eye, and snout, with increase in body length. Although specimens about 30 mm. in length have a coloration typical of the adults, the head, barbel, and snout are considerably shorter. Small specimens, 30 to 50 mm., show a rapid increase in the length of head, barbel, and snout in respect to body length, whereas in specimens greater than 50 mm. this differential rate of development is reduced almost completely except in the length of snout, which increases steadily with increase in body length. The diameter of the eye shows an interesting regression when related with length of body for it decreases uniformly with increase in body length.

These data demonstrate how the large specimens may look completely ornate; with their small eye and extremely long snout; especially so in specimens having the coloration faded. Specimens such as these may represent several of the nominal species of *Parupeneus* considered in the doubtful status.

P. barberinus superficially resembles *macronemus* but the dark spot on the peduncle is much larger and located at the midbase of the caudal fin rather than dorsolaterally on the caudal peduncle. The characters given by Smith (Sea fishes of southern Africa, p. 229, 1949) to distinguish between these species, such as the elongation of the last rays of the soft dorsal and anal fins, is completely erroneous for this condition represents an age character in both species. His illustration of *macronemus* (fig. 565), lacks detail and accuracy in the size and location of the caudal spot.

TABLE 65.—*Length of head and barbel as a percentage of standard length in* Parupeneus barberinus *from various Indo-Pacific localities, by size group*

Standard length in mm.	Head length									Barbel length								
	31	32	33	34	35	36	37	38	39	18	19	20	21	22	23	24	25	26
30- 49	2	2	3			1				2	1	1	2	1		1		
50- 69				1	3	5	2						1	1	2	4	2	1
70- 89					2		1							2		1		
90-109			1	2	3								1	3	1	1		
110-129			1	2											2			
130-149			1	4	4							1	2	3	2		1	
150-169					2									1			1	
170-189							1										1	
190-209																		
210-229																		
230-249						1			1						1			1

TABLE 66.—*Number of gill rakers in* Parupeneus barberinus, *by locality*

Locality	Upper limb			Lower limb					Total[1]					
	6	7	8	19	20	21	22	23	26	27	28	29	30	31
East Indies, Philippines	11	21	1	2	3	10	13	5	1	3	7	6	10	6
Okinawa Island		1				1					1			
Marshall Islands	14	4			6	10	2			4	10	4		
Marianas Islands	20	1			5	13	3			5	11	5		
Solomon Islands	1						1					1		
Gilbert Islands	1					1					1			
Samoan Islands	1						1					1		
Tuamotu Archipelago	1					1					1			

[1] Raker at the angle of the arch was included only in the total count.

Table 67.—*Diameter of eye and length of snout as a percentage of standard length in* Parupeneus barberinus *from various Indo-Pacific localities, by size groups*

Standard length in mm.	Eye						Snout													
	5	6	7	8	9	10	10	11	12	13	14	15	16	17	18	19	20	21	22	23
30-49	----	----	----	6	1	1	1	3	2	1	----	1	----	----	----	----	----	----	----	----
50-69	----	----	----	7	4	----	----	----	----	----	----	1	3	5	2	----	----	----	----	----
70-89	----	----	2	2	----	----	----	----	----	----	----	----	----	1	2	----	----	----	----	----
90-109	----	2	4	----	----	----	----	----	----	----	----	----	1	----	3	2	----	----	----	----
110-129	----	1	1	----	----	----	----	----	----	----	----	----	----	----	2	----	----	----	----	----
130-149	----	8	1	1	----	----	----	----	----	----	----	----	----	1	3	4	2	----	----	----
150-169	----	2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	1	1	----	----
170-189	----	1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	1	----	----
190-209	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
210-229	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
230-249	1	1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	1	----	1

PARUPENEUS BIFASCIATUS (Lacepède)

Plate 77,A

Mullus bifasciatus Lacepède, Histoire naturelle des poissons, vol. 3, pp. 383 and 404, pl. 14, fig., 1802 (no locality).

Parupeneus andrewsii Regan, Proc. Zool. Soc. London, p. 403, pl. 65, 1909 (type locality, Christmas Island, Indian Ocean).

Parupeneus bifasciatus Weber and de Beaufort, Fishes of the Indo-Australian Archipelago, vol. 6, p. 386, 1931 (in part).—Schultz, U. S. Nat. Mus. Bull. 180, p. 130, 1943.

Pseudupeneus bifasciatus Fowler, U. S. Nat. Mus. Bull. 100, vol. 12, No. 1513, p. 291, 1933; Mem. Bishop Museum, vol. 12, No. 2, p. 95, 1949.

Upeneus bifasciatus Herre and Montalban, Philippine Journ. Sci., vol. 36, No. 1, p. 118, pl. 6, fig. 2, 1928.

Upeneus semifasciatus Macleay, Proc. Linnean Soc. New South Wales, vol. 8, 1883, p. 263, 1884 (type locality, Hood Bay, New Guinea).

SPECIMENS STUDIED

Guam: 1 specimen, 59 mm. in standard length.

Rota Island: 1 specimen, 142 mm.

In addition 43 lots totaling 91 specimens were examined from: East Indies and Philippines, 33 lots, 57 specimens; Phoenix and Samoan Islands, 8 lots, 32 specimens; Society Islands, 2 lots, 2 specimens.

Description.—The following counts and measurements were taken from the two specimens from the Marianas Islands (those taken of certain critical characters from specimens other than the Marianas Islands are listed in tables 68–70): Dorsal rays VIII—i, 8; anal rays I, i, 6; pectoral rays ii, 14; vertical scale rows 28; scale rows above lateral line 3, below lateral line 7, around caudal peduncle 14.

Body depth 2.9 and 3.3, head length 3.1, length of caudal peduncle 3.6, 3.7; length of longest pectoral ray 4.2 and 5.0; all in standard length. Eye, 4.2 and 4.9, length of upper jaw 2.6 to 3.0, depth of caudal peduncle 2.7 to 2.8, length of snout 1.8 and 2.3, interorbital width 3.5 and 4.0, length of barbel 1.7 and 1.9; all in length of head. Eye in snout 1.7 and 2.6. Interorbital width in eye 0.7 to 1.0. Gill-rakers, 8+1+28, total 37; longest raker about 1.2 to 1.3 in longest filament.

Teeth of the upper and lower jaws uniserial, blunt, and spaced a moderate distance apart; no teeth on vomer and palatines; scales on caudal fin, absent on dorsal and anal fins; barbels extend to about the posterior margin of eye, sometimes reaching just before posterior margin and sometimes extending beyond this margin; second dorsal spine about 1.3 in length of third dorsal spine, second dorsal spine pungent, the tip not flexible; peritoneum transparent, lateral line complete; scales ctenoid, with about 5 to 7 radii in the anterior field; last rays of soft dorsal and anal fins slightly elongated.

Color in alcohol.—Head and body light tan to dusky; 3 dark saddles or traverse bands on body: The anterior saddle extends from about the anterior half of the base of the spinous dorsal fin to the ventrolateral portion of the belly; the middle saddle, a bar, extends from the base of the soft dorsal fin almost to the base of the anal fin; the posterior saddle extends from the dorsal portion of the caudal peduncle, just before the procurrent rays of the caudal fin, to just below the lateral line; these saddles, especially the anterior one, may be greatly faded in some specimens. The spiny dorsal fin is transparent, with some dusky near the tip; the soft dorsal is marked with 5 to 6 alternating transparent and dusky horizontal stripes; the caudal is dusky to transparent; the pectoral is transparent; the pelvic fin is transparent to dusky, with the outer margin of the fin white; the anal fin is light to dusky, with more dusky located near the tips of the rays, and traces of possibly 3 dusky stripes.

Range.—This species has been reported from Madagascar (Sauvage, Histoire naturelle des poissons, *in* Grandidier, Histoire . . . de Madagascar, vol. 16, p. 221, 1891) eastward through the Indian Ocean, East Indies, Philippines and island groups of Oceania east to the Society Islands and northeast to the Hawaiian Islands (Fowler, Mem. Bishop Mus., vol. 10, p. 227, 1928). It has not been reported from Japan. Since *bifasciatus* has been considerably confused with *trifasciatus* and *multifasciatus* by various authors, the specimens involved in the reports of Sauvage and Fowler should be reexamined. These localities represent certain east and west extremes in the distribution, and the material may involve different species.

Remarks.—The snout and barbel elongate considerably with increase in body length and the eye becomes proportionately smaller.

There may be a tendency for specimens from Oceania to have a greater number of gillrakers than those from the East Indies and Philippines.

Table 68.—*Number of gill rakers in* Parupeneus bifasciatus, *by locality*

Locality	Upper limb			Lower limb						Total[1]							
	7	8	9	26	27	28	29	30	31	34	35	36	37	38	39	40	41
East Indies-Philippines	9	28	1	5	10	16	6	1		1	8	10	12	5	2		
Marianas Islands		2				2							2				
Phoenix Island		3	1				2	2						3	1		
Samoan Islands		8	2		2	2	5	1				2	2	4	1	1	
Society Islands			2					1	1							1	1

[1] Raker at the angle of the arch was included only in the total count.

Table 69.—*Diameter of eye and length of snout as a percentage of standard length in* Parupeneus bifasciatus *from various Indo-Pacific localities, by size-groups*

Standard length in mm.	Eye				Snout						
	6	7	8	9	14	15	16	17	18	19	20
60–79		1	2	6	2	4	2				
80–99		2	5	3		2	5	4			
100–119											
120–139			2				1		1		
140–159		2	2				2	2			
160–179	1	3	1					3	2		
180–199		6	2					2	4	2	
200–219		5							4		
220–239										1	
240–259		2									2

Table 70.—*Length of head and barbel as a percentage of standard length in* Parupeneus bifasciatus, *from various Indo-Pacific localities, by size groups*

Standard length in mm.	Head length						Barbel length								
	30	31	32	33	34	35	15	16	17	18	19	20	21	22	23
60–79	1	1	3		3	1		1	2	4	1	1			
80–99		1	3	5	1		1		6	1	2				
100–119															
120–139			1	1							1	1			
140–159		1	2	1						1	2	1			
160–179		1	3		1						1		2	2	
180–199			2	3	4							1	6		1
200–219			1	2	1								2	1	
220–239					1									2	
240–259					1	1									2

PARUPENEUS TRIFASCIATUS (Lacepède)

Plate 77,C

Mullus trifasciatus Lacepède, Histoire naturelle des poissons, vol. 3, pp. 383 and 404, pl. 15, fig., 1802 (no locality).

Parupeneus trifasciatus Weber and de Beaufort, Fishes of the Indo-Australian Archipelago, vol. 6, p. 382, 1931.—Schultz, U. S. Nat. Mus. Bull. 180, p. 130, 1943.

Pseudupeneus moana Jordan and Seale, Bull. U. S. Bur. Fish., vol. 25 (1905), p. 274, 1906 (type locality, Apia, Samoa).—Snyder, Proc. U. S. Nat. Mus., vol. 32, p. 89, fig. 1, 1907.

Pseudupeneus trifasciatus Fowler, U. S. Nat. Mus. Bull. 100, vol. 12, No. 1513, p. 295, fig. 24, 1933. Mem. Bishop Museum, vol. 12, No. 2, p. 95, 1949.

Upeneus atrocingulatus Kner, *in* Steindachner and Kner, Sitzb. Akad. Wiss. Wien, vol. 61, p. 443, 1870 (type locality, Savay).

Upeneus moana Herre and Montalban, Philippine Journ. Sci., vol. 36, No. 1, p. 124, pl. 4, fig. 2, 1928.

Upeneus trifasciatus Günther, Journ. Museum Godeffroy, vol. 2 (Fische der Südsee, pt. 3), p. 59, pl. 44, fig. B (not C), 1873.

SPECIMENS STUDIED

Bikini Atoll: 24 stations, 72 specimens, 43 to 184 mm. in standard length.
Eniwetok Atoll: 1 station, 2 specimens, 92 and 106 mm.
Kwajalein Atoll: 1 specimen, 112 mm.
Likiep Atoll: 2 lots, Univ. Washington, 2 specimens, 81 and 90 mm.
Rongelap Atoll: 6 stations, 30 specimens, 46 to 150 mm.
Rongerik Atoll: 5 stations, 31 specimens, 45 to 146 mm.
Rota Island: 1 lot, 2 specimens, 164 and 193 mm.
Guam: 2 lots, 3 specimens, 49 to 53 mm.
Saipan: 1 specimen, 52 mm.

In addition, 49 lots totaling 110 specimens were examined from: East Indies and Philippines, 37 lots, 54 specimens; Japan and Ryukyu Islands, 2 lots, 4 specimens; Formosa, 1 specimen; China, 1 specimen; Caroline Islands, 1 specimen; Phoenix and Samoan Islands, 4 lots, 46 specimens; Society Islands, 3 lots, 3 specimens.

Description.—The following counts and measurements were taken unless indicated otherwise, from 5 specimens from the Marshall Islands, ranging in length from 47 to 162 mm. (Counts and measurements of specimens from other Indo-Pacific localities are also included in tables 71–73): Dorsal rays VIII-i,8; anal rays I,i6; pectoral rays (28 specimens), ii,13 and ii,14; vertical scale rows, 22 specimens, 27 to 29; scale rows above lateral line, 3, below lateral line 6, around caudal peduncle (16 specimens), 13 and 14.

Body depth 3.5 to 4.3; head length 2.9 to 3.3; length of caudal peduncle 3.8 to 4.1; length of longest pectoral ray 3.9 to 4.6; all in standard length. Eye, comparatively larger in smaller specimens, 3.6 to 5.8; length of upper jaw 2.4 to 3.0; depth of caudal peduncle 2.9 to 3.3; length of snout 1.8 to 2.8; interorbital width 3.8 to 4.7; length of barbel 1.3 to 1.6; all in length of head. Eye in snout 1.3

to 3.3. Interorbital width in eye 0.7 to 1.1. Gill rakers, 8 to 10+1+28 to 31, total 37 to 42 in 25 specimens from the Marshall Islands; longest raker about 1.2 to 1.3 times longer than longest filament.

Teeth of the upper and lower jaws uniserial, blunt, stout, and spaced a moderate distance apart; those in the upper jaw number about 20 to 24, in the lower jaw, 18 to 23; no teeth on vomer and palatines; scales on caudal fin, absent on dorsal and anal fins; barbels extend beyond eye, reaching posteriormost (upper) portion of margin of preopercle; second dorsal spine about 1.4 in length of third dorsal spine, pungent, the tip not flexible; peritoneum transparent; lateral line complete; scales ctenoid, with 5 to 7 radii in anterior field; last ray of dorsal fin greatly elongate, about 1.5 to 2.0 times longer than other rays of fin, last ray of anal fin about 1.3 times longer than other rays of fin.

Color in alcohol.—Head and body light tan to dusky; barbels tan; a diffuse dark brown stripe from snout to eye, often completely faded, ends just posterior to eye in the form of a dark brown spot or blotch; the characteristic color pattern of this species is the presence of 4 to 5 dark brown to black dorsal saddles on the body, each extending from the middorsal area below the lateral line to the ventrolateral portion of the body; the two anterior saddles are often greatly faded and almost obscure; the first saddle (anteriormost), is located just before the spinous dorsal fin and is about 1 to 1.5 times wider than eye; the second saddle is wide, about 1.5 to 2.0 times diameter of eye, and passes through middle of spinous dorsal fin; the third saddle is narrow, slightly less than diameter of eye, and passes between spinous and soft dorsal fins; the fourth saddle, darker and more conspicuous than those anterior to it, passes through the anterior portion (first 5 rays) of the soft dorsal fin and is slightly wider than diameter of eye; the fifth saddle (posteriormost) passes over caudal peduncle just before base of caudal fin, its width is about 1.3 times greater than eye and it, too, is dark and conspicuous; a white saddle, located between the fourth and fifth dark saddles, is present on caudal peduncle; this white mark is variable in size, extending usually to the lateral line, but in some specimens extends below the lateral line to ventral portion of peduncle; pectoral fin transparent; spinous dorsal with margin of first spine dusky, remainder transparent; soft dorsal with a black bar just above and parallel to base, but extending to tip of membrane of last ray, remainder of fin transparent; margin of outer ray of pelvic fin slightly dusky, remainder of fin transparent; anal fin with 3 narrow light tan stripes on outer half and parallel to base, remainder of fin transparent; outer margins of caudal fin edged with black, remainder of fin slightly dusky to transparent.

Although great variation exists in the intensity of color on the body, the pattern is uniform.

Color in life.—From kodachrome transparency, snout brown to pupil, with 3 or 4 blue lines from eye to tip; one blue line passes through iris of upper part of eye and ends just posterior to eye; opercle with a brownish purple patch; bar from snout to eye very diffuse and dusky; spot behind eye black and conspicuous; base of pectoral fin purple brown; saddles gray to black; scales with diffuse light blue margined in yellow, the bluish becoming circular spots towards base of caudal fin; pectoral fin light yellow; spinous dorsal light orange near base, becoming light yellow towards tips; basal half of spinous dorsal with black rays; the membrane dusky with dashes of yellow; upper half of fin with 4 narrow yellow stripes parallel to base, remainder of fin transparent; pelvic fin with 3 or 4 alternating blue and yellow stripes, the base of fin orange and its outer edge tipped in black; anal fin with 3 yellow wavy stripes on outer half more or less parallel to base, the basal half with yellow stripes broken into irregular spots; basal portion of anal fin with purple background, outer part transparent; rays of caudal yellow, yellow to purple near base; outer margin of lobes black, the membrane of fin transparent.

Range.—This species has been reported from the Indian Ocean and ranges eastward through the East Indies, Philippines, and Islands of Oceania to the Society and Tuamotu groups. It is known from southern Japan and southeastern China. It has not been reported in the Hawaiian Islands. Fowler (Acad. Nat. Sci. Philadelphia Monogr. 2, p. 284, 1938) reported it from Johnston Island, but his specimen should be reexamined, for it possibly may represent *P. multifasciatus.*

Remarks.—In applying the name *trifasciatus* to this species, I have followed the reasoning of Weber and de Beaufort (1931, pp. 384–385) wherein *trifasciatus* (Lacepède, 1802, p. 404, pl. 15) is distinguished from *bifasciatus* (Lacepède, 1802, p. 404, pl. 14). However, the crude manner in which Lacepède's figures of these two species were completed and his inadequate description certainly invites suspicion concerning this distinction. Jordan and Seale (1906, p. 274) were so positive Lacepèdes species were identical that they described their Samoan specimens as a new species *Pseudupeneus moana,* which is here placed in the synonymy of *trifasciatus.*

No evidence was found from examination of specimens over a wide area of the Indo-Pacific to support the naming of subspecies of *trifasciatus* on the basis of color pattern, as Weber and de Beaufort have done. A significantly lower number of gill rakers was found in specimens from the East Indies and Philippine Islands (average about 37) than in those from the Islands of Oceania (average about

39). These data only suggest racial differentiation, for the overlap in the frequency distributions of the gill raker counts from these two general areas (see table 71) is too great to recognize them as subspecies.

TABLE 71.—*Number of gill rakers in* Parupeneus trifasciatus, *by locality*

Locality	Upper limb				Lower limb						Total [1]							
	7	8	9	10	27	28	29	30	31	32	35	36	37	38	39	40	41	42
East Indies-Philippines	6	31	5	----	11	19	10	2	----	----	3	9	18	8	3	1	----	----
Japan-Ryukyu Islands	----	2	2	----	----	2	----	2	----	----	----	----	1	1	1	1	----	----
Formosa-Hong Kong	----	2	----	----	----	1	----	1	----	----	----	----	1	----	1	----	----	----
Bonin Islands	----	1	----	----	----	----	----	1	----	----	----	----	----	----	1	----	----	----
Caroline Islands	----	----	1	----	----	----	1	----	----	----	----	----	----	----	1	----	----	----
Marshall Islands	----	7	15	3	----	2	9	10	4	----	----	----	2	3	7	8	4	1
Marianas Islands	----	----	2	----	----	----	----	2	----	----	----	----	----	----	----	2	----	----
Samoan Islands	----	18	24	----	----	1	12	17	10	2	----	----	----	7	13	15	5	2
Society Islands	----	----	4	----	----	----	----	----	3	1	----	----	----	----	----	1	2	1
Marquesas Islands	1	----	----	----	----	----	1	----	----	----	----	----	1	----	----	----	----	----

[1] Raker at the angle of the arch was included only in the total count.

TABLE 72.—*Diameter of eye and length of snout as a percentage of standard length in* Parupeneus trifasciatus *from various Indo-Pacific localities, by size groups*

Standard length in mm.	Eye					Snout										
	5	6	7	8	9	11	12	13	14	15	16	17	18	19	20	21
40- 59	----	----	2	4	----	3	1	----	----	----	2	----	----	----	----	----
60- 79	----	----	----	6	2	----	----	----	----	----	5	3	----	----	----	----
80- 99	----	----	3	2	----	----	----	----	----	----	2	2	1	----	----	----
100–119	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
120–139	----	2	1	----	----	----	----	----	----	----	----	1	1	1	----	----
140–159	----	2	1	----	----	----	----	----	----	----	----	----	2	1	----	----
160–179	----	8	1	----	----	----	----	----	----	----	----	----	5	4	----	----
180–199	----	5	----	----	----	----	----	----	----	----	----	----	2	1	1	1
200–219	1	2	----	----	----	----	----	----	----	----	----	----	----	3	----	----

TABLE 73.—*Length of head and barbel as a percentage of standard length in* Parupeneus trifasciatus *from various Indo-Pacific localities, by size groups*

Standard length in mm.	Head length									Barbel length										
	30	31	32	33	34	35	36	37	38	20	21	22	23	24	25	26	27	28	29	30
40–59	1	1	2	----	1	----	----	1	----	2	3	----	----	1	----	----	----	----	----	----
60–79	----	----	----	3	2	3	----	----	----	----	----	----	----	1	2	2	2	----	1	----
80–99	----	----	----	2	1	2	----	----	----	----	----	----	----	----	2	1	2	----	----	----
100–119	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
120–139	----	----	1	----	----	----	----	----	----	----	----	----	----	----	----	1	1	----	1	----
140–159	----	----	2	1	1	----	----	----	----	----	----	----	----	----	----	3	----	----	----	1
160–179	----	----	2	2	4	----	----	----	----	----	----	----	----	----	2	----	1	2	1	2
180–199	----	----	1	3	----	----	----	----	1	----	----	----	----	----	----	----	1	2	1	1
200–219	----	----	----	1	2	----	----	----	----	----	----	----	----	----	----	1	1	----	----	1

PARUPENEUS PLEUROSTIGMA (Bennett)

Plate 77,E

Upeneus pleurostigma Bennett, Proc. Zool. Soc. London, vol. 1, p. 59, 1831 (type locality, Mauritius).—Herre and Montalban, Philippine Journ. Sci., vol. 36, p. 122, pl. 5, fig. 2, 1928.

Mullus pleurostigma Playfair, *in* Playfair and Günther, Fishes of Zanzibar, p. 40, 1866.

Parupeneus pleurostigma Bleeker, Atlas ichthyologique . . . , vol. 9, pl. 393, fig. 3, 1878.—Weber and de Beaufort, Fishes of the Indo-Australian Archipelago, vol. 6, p. 398, 1931.

Pseudupeneus pleurostigma Jenkins, Bull. U. S. Fish. Comm., vol. 22, p. 456, (1902) 1903.—Snyder, Bull. U. S. Fish. Comm., vol. 22, p. 527 (1902) 1904.—Jordan and Evermann, Bull. U. S. Fish. Comm., vol. 23, pt. 1, p. 260, fig. 108 (1903) 1905.—Fowler, U. S. Nat. Mus. Bull. 100, vol. 12, p. 275, 1933.

Upeneus brandesi Bleeker, Nat. Tijdschr. Nederl.-Indië, vol. 2, p. 236, 1851 (type locality, Banda Neira).

SPECIMENS STUDIED

Bikini Atoll: 9 stations, 44 specimens, 48 to 169 mm. in standard length.

Rongelap Atoll: 2 stations, 85 specimens, 49 to 104 mm.

In addition, 10 lots totaling 19 specimens were examined from the following localities: Philippine Islands, 2 lots, 5 specimens; Okinawa, 1 lot, 2 specimens; Hawaiian Islands, 7 lots, 12 specimens.

Description.—The following counts and measurements were taken from 6 specimens unless indicated otherwise, all from the Marshall Islands and ranging in standard length from 80 to 151 mm. (counts and measurements of specimens from other areas of the Pacific are also included in tables 74–76): Dorsal rays VIII–i,8; anal rays I,i,6; pectoral rays ii,13 to ii,15(18 specimens); vertical scale rows 28; scale rows above lateral line 3; scale rows below lateral line 6; scale rows around caudal peduncle 14.

Body depth 3.7 to 3.9; head length 2.9 to 3.0; length of caudal peduncle 3.7 to 3.9; all in standard length. Eye 4.5 to 5.3; length of upper jaw 2.8 to 3.1; depth of caudal peduncle 3.5 to 3.9; length of snout 1.9 to 2.1; width of interorbital 4.5 to 5.1; length of barbel 1.4 to 1.7; all in length of head. Gill rakers 6 or 7+1+21 to 23, total 29 to 32 (18 specimens); longest raker only slightly smaller than longest filament.

Teeth of the upper and lower jaws uniserial, blunt, stout and widely spaced; those in upper jaw about 32 and in lower jaw about 26; no teeth on vomer or palatines; scales on caudal fin, absent on dorsal and anal fins; barbels extend beyond vertical, touching posterior margin of eye but do not reach vertical touching posteriormost edge of preopercle; first dorsal spine about one-sixth length of second spine, second spine about three-fourths length of third spine, its tip not flexible; peritoneum light; lateral line complete; scales ctenoid, with

4 to 6 radii in anterior field; pectoral fin pointed, posterior branch of last ray of soft dorsal fin slightly elongate, that of anal conspicuously elongate, about one-third longer than length of sixth anal ray.

Color in alcohol.—Head and body tan, dusky to dusky tan above, light below; barbels light; the characteristic color mark is a blackish irregular to rectangular spot or blotch located on the midbody area below the end of the spiny dorsal, or its center at a point where the longest ray of the pectoral fin touches the lateral line, this spot almost divided into halves by the lateral line, sometimes twice as deep as wide, greatest depth equal to length of snout; located immediately posterior to dark spot is a very light spot extending from half a scale row below base of soft dorsal fin to about half a scale row below lateral line; this light spot equal to or slightly longer than length of base of soft dorsal fin; a diffuse, dusky saddle is located posterior to last two rays of soft dorsal fin, extending to one scale row below lateral line and half the distance to end of caudal peduncle, very faint or completely obscure in some specimens; basal third of soft dorsal fin is black, remainder of fin light or transparent; all other fins are light or transparent. The young in transformation stages, taken at night, are dusky to blackish with only a faint dorsolateral spot (see remarks below).

Color in life.—The following color notes were taken from a kodachrome transparency photographed by Dr. Donald Strasburg from a specimen about 6 inches in total length: Head and body light silvery, suffuse with orange-red on lips, snout, operculum, and dorsally on head, and in lesser amounts dorsolaterally on body; a black spot dorsolaterally below end of spiny dorsal fin; spiny dorsal reddish; soft dorsal with an intense black basal bar on lower half of fin, the upper portion dusky to pale tinted with some orange; anal fin dusky, with some orange; caudal fin light orange at base, becoming lighter toward outer portion; barbels light; iris orange with some black, pupil deep black.

Range.—*P. pleurostigma* is a wide-ranging species that has been reported from the east African coast eastward to the Hawaiian Islands.

Remarks.—As is characteristic in several species of *Parupeneus*, the length of snout and barbel in *pleurostigma* increase with growth and the eye becomes smaller. The most abrupt change occurs at a length of 40 to 60 mm., probably associated with the transformation from the pelagic stage.

The color of 81 specimens, 49 to 56 mm. in length, from Rongelap Atoll, taken July 1, 1946, at night, is dusky to blackish, with the fins transparent to dusky. The black, dorsolateral spot on the body is faint, barely discernible in many of the specimens. The spot varies in size, just developing in some specimens. Another 157 specimens, chiefly smaller in size but ranging from 33 to 58 mm. in length, were taken with the above collection and are similar in coloration and morphological characters but lack the distinctive dark dorsolateral spot on the body. These are probably also *pleurostigma*, representing a stage just prior to the formation of the spot.

TABLE 74.—*Diameter of eye and length of snout as a percentage of standard length in* Parupeneus pleurostigma, *from the Marshall and Hawaiian Islands, by size groups*

Standard length in mm.	Eye					Snout											
	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
40–59			4			5	4										
60–79			1	1							1	1					
80–99			1	2							2	1					
100–119			2	2	1								2	3			
120–139			3	3									1	4	1		
140–159		2	2											2	2		
160–179			1												1		
180–199	1													1			
200–219	1														1		
220–239		1															1

TABLE 75.—*Length of head and barbel as a percentage of standard length in* Parupeneus pleurostigma, *from the Marshall and Hawaiian Islands, by size groups*

Standard length in mm.	Head length								Barbel length											
	28	29	30	31	32	33	34	35	15	16	17	18	19	20	21	22	23	24	25	26
40–59	1	7		1					2	3	1	2								
60–79						1	1								2					
80–99					2		1							1		1	1			
100–119							4							2	1		2			
120–139						2	2	3							1	1	2	1	1	
140–159						2	2							1	1	1	1			
160–179							1									1				
180–199					1											1				
200–219					1										1					
220–239							1													1

TABLE 76.—*Number of gill rakers in* Parupeneus pleurostigma, *by locality*

Locality	Upper limb			Lower limb			Total [1]				
	6	7	8	21	22	23	28	29	30	31	32
Okinawa Islands	1	1		2			1	1			
Marshall Islands	4	13	1	1	8	9		4	6	7	1
Hawaiian Islands	3	4		1	4	2	1	1	4	1	

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[1] The raker at the angle of the arch was included only in the total count.

PARUPENEUS CYCLOSTOMUS (Lacepède)

PLATE 76,B

Mullus cyclostomus LACEPÈDE, Histoire naturelle des poissons, vol. 3, pp. 383, 404, pl. 14, fig. 3, 1802 (type locality not given).

Upeneus cyclostomus CUVIER and VALENCIENNES, Histoire naturelle des poissons, vol. 3, p. 472, 1829.—HERRE and MONTALBAN, Philippine Journ. Sci., vol. 36, No. 1, pp. 127, pl. 6, fig. 3, 1928.

Pseudupeneus cyclostomus JORDAN and SEALE, Bull. U. S. Bur. Fish., vol. 25 (1905) p. 275, 1906.—FOWLER, U. S. Nat. Mus. Bull. 100, vol. 12, p. 304, 1933.— SMITH, Sea fishes of Southern Africa, p. 230, 1949.—FOWLER, Mem. Bishop Mus., vol. 12, No. 2, supp. 3, p. 95, 1949.

Mullus chryserydros LACEPÈDE, Histoire naturelle des poissons, vol. 3, pp. 384, 406, 1802 (type locality, Mauritius).

Upeneus chryserydros CUVIER and VALENCIENNES, Histoire naturelle des poissons, vol. 3, p. 470, 1829.—HERRE and MONTALBAN, Philippine Journ. Sci., vol. 36, No. 1, pp. 127, pl. 5, fig. 3, 1928.

Upeneus chryserythrus GÜNTHER, Journ. Mus. Godeffroy, vol. 2 (Fische der Südsee, pt. 3), p. 60, pl. 45, fig. A, 1873.

Parupeneus chryserydros BLEEKER, Atlas ichthyologique . . ., vol. 9, pl. 393, fig. 2, 1878.—WEBER and DE BEAUFORT, Fishes of the Indo-Australian Archipelago, vol. 6, p. 404, 1931.—SCHULTZ, U. S. Nat. Mus. Bull. 180, p. 130, 1943.

Pseudupeneus chryserydros JORDAN and EVERMANN, Bull. U. S. Fish Comm., vol. 23 (1903), pt. 1, p. 255, 1905.—JORDAN and SEALE, Bull. U. S. Bur. Fish., vol. 25 (1905), p. 275, 1906.

Upeneus oxycephalus BLEEKER, Act. Soc. Sci. Indo-Néerl., vol. 1, p. 45, 1856 (type locality, Manado, Celebes).

Parupeneus xanthospilurus BLEEKER, Verh. Akad. Wet. Amsterdam, vol. 15, No. 3, p. 37, 1875 (type locality, Amboina).

Upeneus saffordi SEALE, Occ. Pap. Bishop Mus., vol. 1 (1900), No. 3, p. 71, 1901 (type locality, Guam).

Pseudupeneus aurantiacus SEALE, Occ. Pap. Bishop Mus., vol. 4, No. 1, p. 48, fig. 14, 1906 (type locality, Tubuai, Austral Islands).

SPECIMENS STUDIED

Bikini Atoll: 11 stations, 13 specimens, 47 to 270 mm. in standard length.
Eniwetok Atoll: 1 station, 2 specimens, 111 to 194 mm.
Rongelap Atoll: 4 stations, 8 specimens, 51 to 89 mm.
Rongerik Atoll: 1 station, 2 specimens, 59 and 77 mm.
Rota Island: 1 specimen, 172 mm.

In addition 20 lots totaling 28 specimens were examined from the following localities: East Indies and Philippines, 8 lots, 14 specimens; Admiralty Islands, 1 specimen; Phoenix and Samoan Islands, 3 lots, 4 specimens; Johnston Island, 1 specimen; Marquesas Islands, 2 lots, 2 specimens; Hawaiian Islands, 5 lots, 6 specimens.

Description.—The following counts and measurements were taken from 7 specimens, unless otherwise indicated (counts and measurements of specimens from other localities are also included in tables 77 and 78); dorsal rays VIII–i,8; anal rays I,i,6; pectoral rays ii,14 to ii,15 (29 specimens); vertical scale rows 27 to 29, scale rows above lateral line 3; scale rows below lateral line 7; scale rows around caudal peduncle 14.

Body depth 3.6 to 4.0; head length 2.8 to 3.0; length of caudal peduncle 3.6 to 4.1; length of longest pectoral rays 4.1 to 4.7; all in standard length. Eye, highly variable with size, comparatively smaller in the larger specimens, 4.9 to 7.1; length of upper jaw 2.3 to 3.4; depth of caudal peduncle 3.0 to 3.3; length of snout 1.7 to 2.0; width of interorbital 3.8 to 5.1; all in length of head. Eye in snout 2.4 (in smallest specimen) to 4.2 (in largest). Width of interorbital in eye, variable, 0.5 to 1.0. Length of barbel in length of head 1.1. Gill rakers, including rudiments, 6 to 8+1+22 to 24, total 29 to 32 in 16 Marshall Islands specimens; longest raker about 1 to 1.2 in longest filament.

Teeth of upper and lower jaws stout, blunt tipped, widely spaced, and in a single row; no teeth on vomer or palatines; scales on caudal fin, absent on dorsal and anal fins; cheek and opercle scaled; barbels long, reach end of head or to base of pelvic fins in most specimens; first dorsal spine minute, second dorsal spine almost as long as third, flexible at tip; peritoneum transparent; lateral line complete; scales ctenoid, with 5 to 6 radii in anterior field; last rays of soft dorsal and anal fins somewhat elongate.

Color in alcohol.—Body and head pale to light tan in most of the smaller specimens, and tan with some dusky in the larger ones. Fins are transparent in smaller specimens, transparent to slightly dusky in larger ones. Barbels are colored light tan. Body, head, and fins of 2 smaller specimens darker, dusky to brown. Light blotch on dorsal portion of the caudal peduncle posterior to soft dorsal fin present in about 40 percent of the specimens from the Marshall Islands. This spot is conspicuously developed in 2 specimens, faint in 2 specimens, questionable in 2, and not perceptible in all others; when present, its size is variable, usually extending half distance from end of base of soft dorsal to procurrent caudal rays, in smaller specimens, to about three-fourths of this distance, in larger ones.

Color in life.—A brownish blue and a yellow color phase have been observed in life by Strasburg who recently collected in the southern Marshall Islands. These color phases correspond with the dusky (dark) and light color phases observed in some of our smaller preserved specimens. It cannot be determined at this time whether these phases are associated with size and maturity, or sex, or reproduction, or whether perhaps two distinct forms are involved. All our larger specimens have a uniform dusky to tan coloration.

The following color description taken in life at Wake Island by John E. Randall, University of Miami, from a specimen 313 mm. in length (USNM 167602) tentatively referred to this species: Body brilliant irridescent blue; head olivaceus, with an olivaceus area extending back from the head a short distance on the body; occasional olivaceus spots on body, especially posteriorly; a concentration of olivaceus blotches dorsally on caudal peduncle; these definitely not appearing as yellow in life, in the water or out; bright blue lines radiating from red eye; dorsal, anal, and caudal fins yellowish with lengthwise bright blue lines.

Range.—This species has an extensive geographical range, having been commonly reported as far west as the Red Sea and East Africa. Our material was taken from the East Indies eastward to the Hawaiian Islands.

Remarks.—This species represents one of the most complex specific problems among the Mullidae, owing to ontogenetic changes in certain morphological structures, such as the length of snout and the size and location of the eye, and to the probable color forms. The length of the snout and the size of the eye show the greatest change with increase in body length, the snout becoming relatively longer and the eye smaller (table 77). The larger specimens thus look quite different. The light spot, or saddle, just posterior to the soft dorsal fin is variable in its size and intensity of development in the adults, and sometimes it is not discernible. Certain specimens from the same locality also may represent two color forms, one having a darker body (bluish in life) and another having a light body (yellowish in life). Consequently the six nominal species in the above synonymy may represent different growth stages or different color forms of one stage.

The possibility that more than one of the nominal forms may represent a species is not yet satisfactorily ascertained, since sufficient comparative material was not available from some of the critical areas of the Indo-Pacific, such as the Indian Ocean and Madagascar. Additional data from living specimens are also needed from all areas of the Indo-Pacific to determine exact color and color patterns, so that possible specific differences may be detected.

The literature referring to this problem is confusing, because the names of two or more of the nominal species have been freely interchanged, the descriptive accounts are not critical, the illustrations are often poorly drawn, and few attempts have been made to develop a concept of the probable mode of differentiation. Interesting discussions concerning various nominal species have been presented by Günther (1873, p. 60), Weber and deBeaufort (1931, p. 406), and Fowler (1933, p. 306).

Lacepède (1802) originally described two of the most controversial nominal species, *cyclostomus* and *chryserydros*. Subsequent interpretations of these forms, coupled with the descriptions of additional ones, has lead to a confusion in the interpretation of possible valid species.

The figure of *cyclostomus* by Lacepède (1802, pl. 14, fig. 3) shows no light spot dorsally on the caudal peduncle.

Bleeker (1878, fig. 2) recognized *chryserydros* as a species with an elongate light spot or saddle extending from the posterior base of the soft dorsal to the procurrent caudal rays, whereas he illustrated (1878, fig. 5) the nominal form *Pseudupeneus xanthospilurus* with a light spot extending only half this distance. He also illustrated his *chryserydros* with a shorter snout, bluish horizontal stripes on the head, and gold and blue stripes on the soft dorsal, whereas the figure of *xanthospilurus* has a longer snout and lacks the color markings. Both Schultz, who collected many of our Marshall Island specimens, and Strasburg, observed no stripes on the head or any other outstanding color markings on the head or body in live specimens, but Strasburg did observe a dusky and a reddish color phase.

From the same subfaunal area from which Bleeker's specimens were taken, Weber and de Beaufort (1931, pp. 404, 407) recognized *chryserydros* and *cyclostomus* as probable species, but had no specimens of the latter. In an adjacent area Herre and Montalban (1928, pp. 123, 127) recognized from the Philippines *cyclostomus* and *chryserydros* as distinct forms based on two specimens of each. They illustrate *cyclostomus* as yellow-orange and lacking the light caudal saddle and *chryserydros* as having a purplish body. Fowler (1933, p. 304) lists all his material from the Philippines under *cyclostomus*, but regarded (p. 309) one specimen (disposition not stated) as *xanthospilurus*. He also recognized (p. 309) the nominal species *chryserydros* from Mauritius, but he had no specimens.

Sauvage (Histoire naturelle des poissons, *in* Grandidier, Histoire . . . de Madagascar, vol. 16, p. 226, pl. 26, figs. 3 & 4, 1891) distinguished the two nominal forms *cyclostomus* and *chryserydros* but illustrated no light dorsal saddle on the caudal peduncle. Smith (1949), who recently has carried out considerable collecting in an area adjacent to Madagascar, recognized only *cyclostomus*.

One or two forms have also been recognized from areas of Oceania. Jordan and Seale (1906, p. 275) noted two species from Samoa, *chryserydros* and *cyclostomus;* the general color of the latter was observed as "clear red without markings" and a "pale saddle on the tail." From the same area Schultz (1943, p. 130) recognized one species. Jordan and Evermann (1905, p. 255) reported one form in the Hawaiian fauna and Fowler's more recent list of fishes of Oceania (1949, p. 95) also reports only one form.

The nominal species *Upeneus oxycephalus* Bleeker, *U. saffordi* Seale, and *Pseudupeneus aurantiacus* Seale, are only tentatively considered as synonyms of *cyclostomus*.

TABLE 77.—*Length of head, barbel, and snout and diameter of orbit as a percentage of standard length in* Parupeneus cyclostomus *from the Philippines and islands of Oceania by size groups*

Standard length in mm.	Head						Barbel												Eye					Snout							
	32	33	34	35	36	37	25	26	27	28	29	30	31	32	33	34	35	36	4	5	6	7	8	13	14	15	16	17	18	19	20
40–79	1	-----	1	3	3	-----	1	1	-----	-----	-----	3	1	2	-----	-----	-----	-----	-----	-----	-----	4	4	2	-----	1	2	3	-----	-----	-----
80–119	-----	2	1	2	2	1	-----	-----	-----	-----	1	3	1	-----	1	-----	-----	-----	-----	-----	3	4	1	-----	-----	-----	1	3	4	-----	-----
120–159	-----	2	1	1	-----	1	-----	-----	-----	-----	-----	1	1	2	-----	1	-----	-----	-----	-----	5	-----	-----	-----	-----	-----	-----	1	1	2	1
160–199	-----	1	2	2	-----	-----	-----	-----	-----	1	1	1	1	1	-----	-----	-----	-----	-----	2	3	-----	-----	-----	-----	-----	-----	-----	1	3	1
200–239	-----	1	3	1	1	-----	-----	-----	-----	-----	1	-----	2	-----	1	1	-----	1	-----	5	1	-----	-----	-----	-----	-----	-----	-----	-----	2	4
240–279	-----	1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1	-----	-----	-----	-----	-----	-----	1	-----	-----	-----	-----	-----	-----	-----	-----	-----	1	-----
280–319	-----	1	-----	-----	-----	-----	-----	-----	-----	-----	1	-----	-----	-----	-----	-----	-----	-----	-----	1	-----	-----	-----	-----	-----	-----	-----	-----	-----	1	-----
320–359	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
360–399	-----	-----	1	-----	-----	-----	-----	-----	-----	-----	1	-----	-----	-----	-----	-----	-----	-----	1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1

The number of gill rakers in East Indies and Philippine specimens averaged less than those from Oceania; and the light peduncular saddle was conspicuously developed in all specimens from the East Indies and Philippines, whereas this was true of only 40 percent of the specimens from the Marshall Islands. These data suggest that the divergence between these two geographical areas is on a racial level. These differences could not be correlated with the dark and light color phases discussed above.

A species, *P. chrysonemus*, with a superficial appearance of the *cyclostomus* complex and known only from the Hawaiian Islands, is distinguished from the latter mainly by its comparatively shorter snout, larger eye, and higher number of gill rakers (see tables 59 to 62).

TABLE 78.—*Number of gill rakers in* Parupeneus cyclostomus, *by locality*

Locality	Upper limb				Lower limb				Total[1]					
	5	6	7	8	21	22	23	24	27	28	29	30	31	32
East Indies-Philippines	1	11	2	-----	4	4	6	-----	1	2	4	7	-----	-----
Marianas Island	-----	1	-----	-----	-----	-----	-----	1	-----	-----	-----	-----	1	-----
Marshall Islands	1	8	6	1	-----	3	8	5	-----	-----	1	3	10	2
Samoan Islands	-----	1	4	-----	-----	1	3	1	-----	-----	-----	1	4	-----
Johnston Island	-----	-----	1	-----	-----	1	-----	-----	-----	-----	-----	1	-----	-----
Hawaiian Islands	-----	3	3	-----	-----	1	3	2	-----	-----	-----	3	2	1

[1] Raker at the angle of the arch was included only in the total count.

PARUPENEUS CRASSILABRIS (Cuvier and Valenciennes)

PLATE 76,E

Upeneus crassilabris CUVIER and VALENCIENNES, Histoire naturelle des poissons, vol. 7, p. 523, 1831 (type locality, New Guinea).—SMITH and SWAIN, Proc. U. S. Nat. Mus., vol. 5, p. 129, 1882.—JORDAN and EVERMANN, Bull. U. S. Fish. Comm., vol. 23 (1903), pt. 1, p. 259, 1905.

Pseudupeneus crassilabris FOWLER, U. S. Nat. Mus. Bull. 100, vol. 12, p. 315, 1933.

SPECIMENS STUDIED

Bikini Atoll: 1 specimen, 203 mm. in standard length.

In addition, 1 specimen (USNM 26824), 265 mm. in length, from Johnston Island, was also examined.

Description.—The following counts and measurements refer to the specimen collected at Bikini Atoll, those in parentheses refer to the Johnston Island specimen: Dorsal rays VIII-i,8 (VIII-i,8); anal rays I,i,6 (I,i,6); pectoral rays ii,14 (ii,15); vertical scale rows 28 (27); scale rows above lateral line 3 (3), below lateral line 7 (7), around caudal peduncle 14 (14).

Body depth 2.9; head length 3.2 (3.0); length of caudal peduncle 3.8 (4.4); length of longest pectoral ray 4.0; all in standard length. Eye 5.3 (5.1); length of upper jaw 2.6 (2.3); depth of caudal peduncle 2.3 (2.8); length of snout 1.8 (1.7); length of barbel 1.5 (1.5); width of interorbital 3.2 (3.5); all in length of head. Eye in snout 2.9 (2.9). Interorbital width in eye 6.1 (6.8). Gill rakers 0, 8+1+26, 2 (0, 9+1+27, 2), totaling 37 (39); longest raker about 0.9 length of longest filament.

Teeth of upper and lower jaws uniserial, blunt, stout and widely spaced; no teeth on vomer or palatines; scales on caudal fin, absent on dorsal and anal; cheeks and opercles scaled; barbels reach vertical touching posterior margin of preopercle; first dorsal spine small, about one-seventh length of second spine; second dorsal spine about four-fifths length of third, tip not flexible; peritoneum transparent; lateral line complete; scales ctenoid, with 4 to 9 radii in anterior field; last ray of soft dorsal fin slightly elongate, that of anal same length as other rays of fin.

Color in alcohol.—Head and body dusky to dusky tan. A diffuse blackish mark or stripe on each side of snout from middle of eye to middle of upper jaw. Some diffuse brownish coloration on chin, cheek, and opercle. An irregular light tan to brown coloration encircles spiny and soft dorsal and is broken in various places, forming irregular spots. The pectoral fin is transparent; the spiny dorsal is transparent, tipped with black; the soft dorsal is transparent, with about 6 dusky to blackish horizontal streaks; the 3 streaks near base of fin formed by nearly circular spots; the tip of the soft dorsal bordered with blackish color; the caudal is dusky, the outer ray edged in white; the anal fin is similar to soft dorsal except the spots and streaks are not so pronounced; pelvic fin light near base, dusky towards tips, the outer edge of first ray and tips of first three rays edged in white. Barbels dusky near base, light brown near tips. The Johnston Island specimen has a barbel blackish from base to tip.

Remarks.—This species has been considered synonymous with *Upeneus luteus* Cuvier and Valenciennes (Histoire naturelle des poissons, vol. 7, p. 521, 1831, type locality, Mauritius) by several authors. The problem is partially reviewed by Weber and de Beaufort (Fishes of the Indo-Australian Archipelago, vol. 6, p. 404, 1931). Certain facts from my data and from the literature lead me to disagree with this contention. First, the characteristic dusky to blackish coloration of the specimens from Bikini and Johnston Island has not been reported by other authors for specimens of *luteus*; and second, the number of gill rakers in these specimens is much higher than that reported in published accounts of *luteus*. Weber and de Beaufort (1931, p. 401) found 20 gill rakers, including rudiments, on the lower limb of *luteus*, and merely listed *crassilabris*, quoting the account of Cuvier and Valenciennes (1831, p. 523), since they had no specimens. Our specimens of *crassilabris* have 28 and 29 rakers (table 59) on the lower limb. From my study of the variability of gill rakers in various species of *Parupeneus*, the differences of counts of 20 and 28 to 29 for the lower limb are so great as to warrant the statement that our specimens certainly cannot be compared with those reported on by Weber and de Beaufort. Fowler (1933, p. 313) listed *luteus* but had no specimens from the area studied, and his single specimen of *crassilabris* was that specimen cited above from Johnston Island.

Day's illustration of *luteus* (Fishes of India, p. 125, pl. 31, fig. 2, 1878) resembles our specimens of *crassilabris* in general body form but the dark margins of the fins, characteristic of our specimens, was not shown. Bleeker's figure of *luteus* (Atlas ichthyologique . . ., vol. 9, pl. (4) 394, fig. 1, 1877) shows numerous light spots on the body, arranged in about 8 horizontal rows; these spots are not present on our specimens of *crassilabris*.

Fowler (Acad. Nat. Sci. Philadelphia Monogr. 2, pp. 124, 201, and 285, 1938) lists the distribution of *crassilabris* as Johnston, Jarvis, Christmas, and Apataki Islands. It has not been reported from the Hawaiian Islands.

A specimen, USNM 71651, 130 mm. in standard length, taken by the Bureau of Fisheries off Japan, might represent *P. luteus*: Its head and body are brownish and the fins dusky; the scales have a dark brown spot located near the center and slightly smaller than the pupil; and these spots, which form about 8 to 9 horizontal lines on the side of the body, are more evident on the caudal peduncle. Otherwise, this specimen resembles the darker specimens of *P. cyclostomus* in our collection. The following counts and measurements were also taken: Vertical scale rows 28; scales around caudal peduncle 14; dorsal rays VIII-i,8; anal rays I,i,6; pectoral rays ii,14; head length 3.0, length of caudal peduncle 4.0, both in standard length; eye 6.0; length of upper jaw 2.9, length of snout 1.7, interorbital width 4.3, length of barbel 1.1, all in length of head. Gill rakers 1,5+1+18,5, totaling 30.

Genus MULLOIDICHTHYS Whitley

Mulloidichthys Whitley, Rec. Australian Mus., vol. 17, No. 3, p. 122, 1929 (type species, *Mullus flavolineatus* Lacepède). (*Mulloidichthys* Whitley, proposed to replace *Mulloides* Bleeker.)

Mulloides (not Richardson, Rep. Fifteenth Meet. British Assoc. Adv. Sci., p. 16, 1846) Bleeker, Verh. Bataviaasch Gen. vol. 22, p. 6, 1849 (type, *Mullus flavolineatus* Lacepède).

The characters that best define the genus are associated with the teeth: dentition incomplete; teeth in the jaws in villiform bands, widest anteriorly, where they are in several irregular rows, and tapering posteriorly to one or two more or less irregular rows; no vomerine or palatine teeth.

The following characters were common to all species of *Mulloidichthys* studied and apply to some of the other genera in the family: Scales on caudal fin, absent on dorsal and anal fins; dorsal fin rays VIII-i,8 the first spine minute, pectoral fin rays 16 to 18; scales above lateral line 3, below lateral line 6 or 7, around narrow portion of caudal peduncle 15 or 16; first elongate spine of spinous dorsal flexible near tip.

This genus inhabits the tropical and subtropical littoral marine waters of the Indo-Pacific, Eastern Pacific, and Western Atlantic regions. At least four species are known from Oceania, three from the Eastern Pacific and one from the Western Atlantic regions. Three species were taken in the Marshall Islands and one from the Marianas.

Characters useful in distinguishing the species are summarized in tables 79 and 80.

No appreciable population divergence was found when comparing various meristic counts, measurements, color, or color pattern in those species where sufficient specimens were available for study from various subfaunal areas. The data comparing the total number of gill rakers showed a tendency toward an East to West gradient when a few specimens were compared, but this was insignificant when larger samples (see descriptions of *samoensis* and *auriflamma*) were available.

Several species reported from Oceania are so little known that their generic allocation is even doubtful. *Pseudupeneus eutaeniatus* Fowler (Proc. Acad. Nat. Sci. Philadelphia, vol. 96, p. 170, fig. 21, 1944, type locality, New Hebrides) may represent a species of *Mulloidichthys*, for his statement, "Teeth minute, uniform close-set, form an apparent row in each jaw, none on palate," comes closer to describing the dentition of *Mulloidichthys.* He may have examined only the villiform tooth patch, which tapers to a row or two of small teeth posteriorly in both jaws. Otherwise *eutaeniatus* could only be referred to the genus *Parupeneus.* His count for the total number of gill rakers (18) is considerably lower than for any species known from Oceania, other than certain *Upeneus* where the lowest count was found to be 19. This may suggest that *eutaeniatus* may represent a species of *Upeneus.* The small palatal teeth in this genus can be easily overlooked. *Pseudupeneus eutaeniatus* Fowler, is known only by the type, which was not available for this study.

Another species which may be referred to the genus *Mulloidichthys* is *Upeneus bilineatus* Fowler (Bernice P. Bishop Mus., Bull. 38, p. 17, fig. 2, 1927, Palmyra Island). Fowler listed the dentition as, "teeth small, simple, conic, uniform, form two rows above anteriorly and five below anteriorly; none on palate or tongue." Herre (Field Mus. Nat. Hist., Zool. Ser., publ. 353, vol. 21, p. 213, fig. 11, 1936) reported it from Nuku Hiva Island, Marquesas Islands, as *Paruppeneus bilineatus*. He commented on his generic allocation (p. 211) referring *bilineatus* to species with teeth arranged uniserially in the jaws. Fowler (Mem. Bishop Mus., vol. 10, p. 233, fig. 47, 1928) cites the original description of *bilineatus* by Cuvier and Valenciennes (Histoire naturelle des poissons, vol. 7, p. 394, 1831, type locality, Amboina), pointing out their reference to the uniserial conic jaw teeth and smooth palate, and erroneously places his Palmyra record with it without mention of his previous statement on the dentition.

TABLE 79.—*Number of gill rakers and vertical scale rows of* Mulloidichthys *from various Indo-Pacific localities*

Species	Total number of gill rakers												Vertical scale rows						
	24	25	26	27	28	29	30	31	32	33	34	35	33	34	35	36	37	38	39
samoensis	1	8	13	39	51	22	14	2					1	7	15	30	12	2	
vanicolensis				1	9	10	5								8	8	4		1
pflugeri				1	1	1											2	1	
auriflamma						1	4	8	18	22	20	6			5	8	12	5	

TABLE 80.—*Measurements of several characters in four species of* Mulloidichthys

Species	In percent of standard length													
	Length of head						Depth of body							
	26–27	28–29	30–31	32–33	34–35	36–37	18–19	20–21	22–23	24–25	26–27	28–29	30–31	32–33
samoensis		1	15	23	4	1		9	3	9	2			1
vanicolensis	9	15					2	11	5					
pflugeri			3								2	1		
auriflamma		2	14	14	2			2	2	1	11	6	1	

Species	In percent of head length													
	Length of barbel									Interorbital width				
	46–49	50–53	54–57	58–61	62–65	66–69	70–73	74–77	78–81	22–23	24–25	26–27	28–29	30–31
samoensis			2	7	19	7	5			10	13	4		1
vanicolensis	2	16	6									10	12	1
pflugeri					1	2							1	
auriflamma					1	8	11	9	4		4	17		1

Table 80.—*Measurements of several characters in four species of* Mulloidichthys—Continued

Species	In percent of head length													
	Length of upper jaw							Diameter of orbit						
	26–27	28–29	30–31	32–33	34–35	36–37	38–39	20–21	22–23	24–25	26–27	28–29	30–31	32–33
samoensis	1	9	10	1		1		1	3	5	13	5	2	
vanicolensis	1	10	10						1	7	14	2		
pflugeri					1		2	1	1	1				
auriflamma			1	9	15	5	1			1	3	11	10	10

Species	Length of snout in percent of head length							
	30–33	34–37	38–41	42–45	46–49	50–53	54–57	58–61
samoensis			8	8	19	5	1	1
vanicolensis		15	9					
pflugeri				2	1			
auriflamma	1	3	16	10	5			

KEY TO THE SPECIES OF MULLOIDICHTHYS FROM OCEANIA

1*a*. Peritoneum dark, dark brown to black.

2*a*. Black spot on side of body below spinous dorsal fin sometimes present; black blotch or spot on inner side of operculum bordering pseudobranchiae usually present; fins pale or transparent; total number of gill rakers range from 24 to 31, modally 28; snout long and moderately rounded, 38 to 58, eye small 21 to 30, barbel intermediate in length 55 to 72, all in percent of head length; head length 29 to 36 in percent of standard length; vertical line touching end of jaw clearly in front of margin of orbit------------------------**M. samoensis** (Günther)

2*b*. No black spot on body nor on inner side of operculum; fins pale to transparent; total number of gill rakers range from 29 to 35, modally 33; snout short and round, 33 to 48, eye large, 25 to 33, barbel long, 65 to 80, all in percent of head length; head 28 to 34 in percent of standard length; vertical line touching end of jaw nearly touches orbit.
M. auriflamma (Forskål)

2*c*. No black spot on body nor on inner side of operculum; striations on soft dorsal and anal fins usually blackish, creating a net-like appearance; total number of gill rakers 27 to 30, modally 29; snout short and pointed, 35 to 39, eye 23 to 28, barbel short, 48 to 55, all in percent of head length; head short, 26 to 29 in percent of standard length.
M. vanicolensis (Cuvier and Valenciennes)

1*b*. Peritoneum light, transparent to silvery-white; body and fins with uniform coloration, lacking prominent pigmentation; total number of gill rakers

27 to 29; snout 43 to 46, eye 21 to 24, barbel 64 to 67, all in percent of head length; head length; 30 to 31 in percent of standard length; plate 78, C------------------------------**M. pflugeri** [17] (Steindachner)

MULLOIDICHTHYS SAMOENSIS (Günther)

PLATE 78,A

Mulloides samoensis GÜNTHER, Journ. Mus. Godeffroy, vol. 2 (Fische der Südsee, pt. 3), p. 57, pl. 43, fig. B, 1873 (type locality, Apia, Samoa).

Upeneus preorbitalis SMITH and SWAIN, Proc. U. S. Nat. Mus., vol. 5, p. 132, 1882 (type locality, Johnston Island; holotype USNM 29662 examined).

SPECIMENS STUDIED

Bikini Atoll: 29 stations, 188 specimens, 77 to 238 mm. in standard length.
Eniwetok Atoll: 8 stations, 81 specimens, 74 to 222 mm.
Rongelap Atoll: 11 stations, 171 specimens, 75 to 210 mm.
Rongerik Atoll: 6 stations, 53 specimens, 80 to 190 mm.
Guam: 7 lots, 18 specimens, 72 to 240 mm.

In addition, 63 lots totaling 283 specimens were examined from the following localities: Red Sea, 2 lots, 3 specimens; East Indies and Philippines, 22 lots, 34 specimens; New Guinea, 1 specimen; Bonin Islands, 2 lots, 2 specimens; Fiji Islands, 1 specimen; Phoenix and Samoan Islands, 14 lots, 76 specimens; Society Islands, 4 lots, 19 specimens; Fanning Islands, 1 specimen; Johnston Island, 3 lots 23 specimens; Hawaiian Islands, 13 lots, 123 specimens.

Description.—Counts and measurements were taken from 10 specimens, all from the Marshall and Marianas Islands unless indicated otherwise, ranging in length from 77 to 242 mm. (additional counts and measurements, including specimens from other localities, are contained in tables 80–82): Dorsal rays VIII-i,8; anal rays I,i,6; pectoral rays 16 or 17; vertical scale rows (67 specimens), 33 to 38; scale rows above lateral line 3, below lateral line 6 or 7, around caudal peduncle 16.

Body depth 3.6 to 4.7 (23 specimens); head length 2.8 to 3.5 (44 specimens); length of caudal peduncle 4.1 to 4.3; length of longest pectoral ray 4.7 to 5.0; all in standard length. Eye, 3.3 to 4.5 (28 specimens); length of upper jaw, 2.7 to 3.6 (22 specimens); depth of caudal peduncle 3.4 to 4.0; length of snout, 1.7 to 2.6 (42 specimens); interorbital width 3.0 to 4.3 (28 specimens); length of barbel 1.4 to 1.8 (40 specimens); all in length of head. Eye in snout 1.3 to 2.1. Interorbital width in eye 1.0 to 1.4.

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[17] *Mulloides pflugeri* Steindachner, Denkschr. Akad. Wiss. Wien, vol. 70, p. 485, pl. 3, fig. 4, 1901 (type locality, Honolulu).—Jordan and Evermann, Bull. U. S. Bur. Fish, vol. 23 (1903), pt. 1, p. 251, 1905.—Jordan and Snyder, Bull. U. S. Bur. Fish., vol. 26 (1906), p. 214, 1907.

Mulloides flammeus Jordan and Evermann, Bull. U. S. Fish. Comm., vol. 22 (1902), p. 186, 1903 (type locality, Kailua).—Jordan and Evermann, Bull. U. S. Fish. Comm., vol. 23 (1903), pt. 1, p. 251, fig. 104, 1905.

Our collections total 3 specimens, USNM 55516, Hawaii; USNM 151522, Honolulu; and USNM 138601, Amboina, East Indies. The latter specimen is tentatively referred to this species. Although it agrees closely with the Hawaiian specimens in respect to counts, measurements and coloration, there is a possibility it may represent a distinct form. Several species in the family which appear to be similar in alcohol have characteristically different life colorations. *M. pflugeri* has been reported only from the Hawaiian Islands.

Gill rakers 7 to 9+1+16 to 21, total 24 to 31 (150 specimens); longest raker about 1.4 to 2.0 in longest filament; peritoneum black; second dorsal spine flexible near tip; barbels extend posterior of vertical through eye but rarely reaching preopercular margin.

Color in alcohol.—Head and body pale, darker above and usually light silvery below. Faint traces of a light median horizontal stripe from eye to base of caudal fin. A black spot or blotch on side of body below spiny dorsal fin sometimes present, often faint or obscure. Fins pale or transparent. A black blotch on inner side of operculum bordering pseudobranchiae usually present, sometimes faded.

Color in life.—These color notes were taken from a kodachrome loaned by Dr. Strasburg, U.S. Fish and Wildlife Service, Honolulu: The specimen was 5½ inches in total length. Cheek, operculum and dorsal portion of head blackish; snout diffuse orange-red; remainder of head silvery; body light silvery below, becoming dark above; spinous dorsal, soft dorsal, and caudal fins dusky to orange; pectoral fins reddish orange; pelvic fins dusky to black near base, orange on outer portion; anal fin with black spot near base, remainder reddish orange; barbels light blue at base, remainder light orange; iris orange to silvery; pupil black.

Range.—The extensive geographic range of *M. samoensis* parallels that of *M. auriflamma,* occurring from the Red Sea eastward through the East Indies, Philippines, and the islands of Oceania through the Hawaiian Islands.

Remarks.—This species is very closely related to *M. auriflamma* with which it can be easily confused, especially the smaller specimens or those poorly preserved. The black blotch present only on the inner side of the operculum of *samoensis* is a good character to distinguish between most specimens of the two species but it is sometimes faded. The black spot on the midside of the body is often completely faded. The diagnostic characters most useful in differentiating these species are the presence of these two spots in combinations with differences in the number of gill rakers, length of barbel, size of eye, the length of snout.

No significant differences were found in an analysis of populations from several localities throughout the Indo-Pacific on the basis of comparing color, meristic counts, and proportional measurements.

TABLE 81.—*Number of gill rakers in* Mulloidichthys samoensis, *by locality*

Locality	Upper arch [1]			Lower arch [1]						Total							
	7	8	9	16	17	18	19	20	21	24	25	26	27	28	29	30	31
Red Sea	3	1	----	1	2	----	1	----	----	1	2	----	----	1	----	----	----
East Indies	1	4	----	----	----	1	4	----	----	----	----	----	2	3	----	----	----
Philippines	3	18	1	----	7	13	1	----	1	----	3	5	11	2	----	1	----
New Guinea	----	----	1	----	----	1	----	----	----	----	----	----	----	1	----	----	----
Bonin	----	1	1	----	----	1	1	----	----	----	----	----	----	1	1	----	----
Marianas Islands	3	3	3	----	1	4	3	1	----	----	----	1	5	1	1	1	----
Marshall Islands	4	15	5	1	----	4	16	2	1	----	1	1	4	14	2	2	----
Fiji	----	1	----	----	----	----	1	----	----	----	----	----	----	1	----	----	----
Phoenix and Samoan Islands	3	16	6	----	5	6	12	1	----	----	2	4	7	6	4	1	----
Society Islands	3	3	2	----	----	1	5	1	1	----	----	----	4	1	2	----	1
Fanning Islands	----	----	1	----	----	----	1	----	----	----	----	----	----	----	1	----	----
Johnston Island	1	13	3	----	1	2	8	5	1	----	----	2	1	7	4	3	----
Hawaiian Islands	2	25	5	----	----	5	12	9	6	----	----	----	5	13	7	6	1

[1] Gill raker at the angle of the arch was included in the total count only.

TABLE 82.—*Change in length of snout with increase in body length in specimens of* Mulloidichthys samoensis *from 81 to 290 mm. in length*

Standard length (mm.)	Length of snout in percent of head length					
	38–41	42–45	46–49	50–53	54–57	58–61
Less than 100	8	5	3	------------	------------	------------
100–149	------------	3	4	1	------------	------------
150–199	------------	------------	12	2	------------	1
200–290	------------	------------	------------	2	1	------------

MULLOIDICHTHYS AURIFLAMMA (Forskål)

PLATE 78,B

Mullus auriflamma FORSKÅL, Descriptiones animalium . . . , p. 30, 1775 (type locality, Djedda, Red Sea).

SPECIMENS STUDIED

Bikini Atoll: 9 stations, 41 specimens, 89 to 225 mm. in standard length.
Eniwetok Atoll: 1 specimen, 170 mm.
Rongelap Atoll: 2 stations, 21 specimens, 93 to 117 mm.
Rongerik Atoll: 1 station, 3 specimens, 99 to 112 mm.

Thirty lots totaling 93 specimens were examined from the following localities: East Indies Islands, 6 lots, 14 specimens; Philippines, 1 specimen; New Guinea, 1 specimen; Bonin Islands, 1 specimen; Phoenix and Samoan Islands, 14 lots, 67 specimens; Tuamotus, 1 specimen; Johnston Island, 2 lots, 2 specimens; Hawaiian Islands, 4 lots, 6 specimens.

Description.—Counts and measurements were taken from 10 specimens, all from the Marshall Islands unless indicated otherwise, ranging in length from 89 to 225 mm. (additional counts and measurements including specimens from other localities are contained in tables 80 and 83): Dorsal rays VIII-i,8; anal rays I,i,6; pectoral rays 16 or 17 (15 specimens); vertical scale rows, 35 to 38 (30 specimens); scale rows above lateral line 3, below lateral line 7, around caudal peduncle 15 and 16.

Body depth 3.3 to 3.8 (23 specimens); head length 3.0 to 3.6 (32 specimens); length of caudal peduncle 4.3 to 4.6; length of longest pectoral ray 4.5 to 4.8; all in standard length. Eye 3.1 to 3.9 (35 specimens); length of upper jaw 2.6 to 3.3 (31 specimens); depth of caudal peduncle 3.0 to 3.7; length of snout 2.1 to 2.8 (35 specimens); interorbital width, 3.4 to 4.0 (22 specimens); length of barbel 1.3 to 1.6 (33 specimens); all in length of head. Eye in snout 1.4 to 1.6. Interorbital width in eye 1.0 to 1.3.

Gill rakers 7 to 10+1+20 to 25, total 29 to 35 (79 specimens); longest raker about 1.2 to 1.6 in longest filament; peritoneum deep black; second dorsal spine fairly flexible near tip; barbels extend to preopercular margin or slightly beyond.

Color in alcohol.—Head and body pale, or light to slightly golden brown, often dusky dorsally. Head and body in some specimens with irregular dark blotches. Fins pale to transparent. Our specimens show no remains on the body of the median yellow horizontal stripe present in life.

Range.—This species has an extensive geographic range. Originally described from the Red Sea, it has been found from the East African coast (Smith, Sea fishes of Southern Africa, p. 231, 1949) eastward through the East Indies, Philippines, Islands of Oceania, and the Hawaiian Islands.

Remarks.—The color and morphological characters of populations of this species in various geographic localities appear homogeneous.

TABLE 83.—*Number of gill rakers in* Mulloidichthys auriflamma, *by locality*

Locality	Upper arch [1]				Lower arch [1]						Total						
	7	8	9	10	20	21	22	23	24	25	29	30	31	32	33	34	35
East Indies	----	5	6	3	----	2	6	6	----	----	----	1	3	5	3	2	----
Philippines	----	----	1	----	----	1	----	----	----	----	----	----	1	----	----	----	----
New Guinea	----	1	----	----	----	----	----	----	----	----	----	----	----	1	----	----	----
Bonin Islands	----	----	----	1	----	----	----	1	----	----	----	----	----	----	----	1	----
Marshall Islands	1	8	26	6	----	----	3	23	12	3	----	----	1	9	14	12	5
Phoenix and Samoan Islands	----	4	8	----	1	1	2	6	2	----	1	1	2	2	4	2	----
Tuamotu Island	----	----	1	----	----	----	----	----	----	1	----	----	----	----	----	----	1
Johnston Island	----	----	2	----	----	----	----	----	2	----	----	----	----	----	----	2	----
Hawaiian Islands	----	1	4	1	1	2	1	2	----	----	----	2	1	1	1	1	----

[1] Gill raker at the angle of the arch was included in the total count only.

MULLOIDICHTHYS VANICOLENSIS (Cuvier and Valenciennes)

Upeneus vanicolensis Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 7, p. 521, 1831 (type locality, Vanicolo, Santa Cruz Islands).

SPECIMENS STUDIED

Bikini Atoll: 8 stations, 26 specimens 77 to 96 mm. in standard length.
Eniwetok Atoll: 4 stations, 53 specimens, 77 to 92 mm.
Rongelap Atoll: 3 stations, 15 specimens, 79 to 93 mm.

Description.—Counts and measurements were taken from 7 specimens all from the Marshall Islands, unless indicated otherwise, ranging in length from 84 to 95 mm. Dorsal rays VIII–i,8; anal rays I,i,6; pectoral rays 16 or 17; vertical scale rows 35 to 39 (21 specimens); scale rows above lateral line 3, below lateral line 6 or 7, around caudal peduncle 15 or 16.

Body relatively elongate and slender, body depth 4.5 to 5.2; head length 3.5 to 3.9; length of caudal peduncle 3.5 to 3.9; length of longest pectoral ray 5.8 to 6.5; all in standard length. Eye, 3.5 to 4.2; length of upper jaw 3.4 to 3.7; depth of caudal peduncle 3.0 to 3.2; length of snout 2.6 to 3.0; interorbital width 3.6 to 3.9; length of barbel 1.8 to 2.1; all in length of head. Eye in snout 1.1 to 1.3; interorbital width in eye 1.0 to 1.2.

Gill rakers 7 or 8+1+18 to 21, total 27 to 30 (25 specimens); longest raker about 1.7 to 2.0 in longest filament. Second dorsal spine flexible near tip; barbels short almost reach vertical through posterior margin of eye.

Color in alcohol.—Head and body dusky to dark brown above and silvery below, lacking any conspicuous color or color mark, some specimens more uniform light brown or tan; peritoneum black; fins transparent, caudal fin and to a lesser extent soft dorsal more conspicuous in having dusky striations in most specimens.

Color when alive.—Schultz recalls that many of the above specimens, especially those collected at night, had a reddish brown coloration when taken from the water. None showed any evidence of stripes or spots as is found on *samoensis* or *auriflamma*.

Range.—This species has been reported from the East Indies, the Philippines, and various islands of Oceania. The references are listed by Fowler (Mem. Bishop Mus., vol. 10, p. 234, 1928) and Herre and Montalban (Philippine Journ. Sci., vol. 36, No. 1, p. 135, 1928). I suspect that more than one species was involved in these reports and one should be cautious in the application of these data.

Remarks.—The following arguments were considered in the use of the name *vanicolensis*:

1. It seemed most logical to apply some available name in order that the specimens may be referred to and found by future workers, although I am not confident of the accuracy of this application. Of

the names available, the description of *Upeneus vanicolensis* Cuvier and Valenciennes best fits my specimens. The type locality is Vanicolo Island, Santa Cruz Islands, a locality not faunistically different from the Marshall Islands in respect to the Mullidae. Characters listed by subsequent authors for this species agree fairly closely with those of mine, although I have no positive assurance of this, since the material studied by them was often not listed nor was it available for examination.

2. It is conceivable that the material may represent the young or juvenile form of some well known species. All were of a juvenile size, 77 to 96 mm. in standard length. On the basis of the material collected, the species was most active at night, for 73 specimens were taken in 11 collections at night with the aid of lights and only 4 collections totaling 21 specimens were taken during the daylight hours when most of the collecting was done. Specimens of *M. samoensis* and *M. auriflamma* were taken with *vanicolensis* in the same net hauls. The greater number of gill rakers, larger eye, and longer barbels of *auriflamma* and the light peritoneum of *pflugeri* eliminate any possibility of associating these species with my specimens of *vanicolensis.*

On the basis of certain meristic counts and measurements, *samoensis* is the species most closely related (see table 80) to specimens of *vanicolensis*; however, my specimens have these pronounced differences from *samoensis*: Most specimens were reddish brown in life and in preservation the striations of the caudal fin are dusky, and no specimen had a dark spot or yellow stripe on the body as in *samoensis*; at comparable sizes the body is slenderer, the snout more pointed, and the mouth more horizontal; certain morphological structures, such as the shorter head, wider interorbital, and shorter snout in *vanicolensis*, show differences that do not appear to be associated with young or with a transforming stage. The barbel is significantly shorter, although this difference might be associated with transformation, as the young may be pelagic and may not require the barbels as do the bottom-feeding adults.

In several species of *Parupeneus*, the adults of which equal or exceed in total length that attained by any species of *Mulloidichthys*, the young have acquired the definitive adult characters at a much smaller size, 40 to 50 mm., than my specimens of *vanicolensis*. The absence of intermediate specimens lead me to drop the theory that my specimens represent an early stage. Life history studies are needed.

3. The last possibility is that these specimens represent a new species. In view of the fact that we do not have a clear understanding just what form *Upeneus vanicolensis* Cuvier and Valenciennes may

represent, and also that we know so very little of the life history, habits, and life coloration of most of the species of Mullidae (items quite important to the taxonomic understanding of the family), I hesitated to proceed with the viewpoint that these specimens are new.

Family POMACENTRIDAE: Damselfishes

By Loren P. Woods and Leonard P. Schultz

No attempt was made to revise this large complicated family consisting of very numerous species, some of which are closely related, of small size, and generally difficult to identify. This latter is especially true if few species are available for comparison.

The family is characterized by having II anal spines, X to XIV dorsal spines; teeth small, conical to compressed, mostly adapted to feeding on algae; a single nostril each side of snout.

Since the pelvic rays normally are I,5 and branched caudal fin rays 7 or 8+6 or 7, usually 7+6, these are omitted in descriptions.

KEY TO THE GENERA OF POMACENTRIDAE FROM THE NORTHERN MARSHALL AND MARIANAS ISLANDS

1*a*. Transverse scale rows more than 50; suborbital and preopercle margins serrate; opercle, subopercle, and interopercle with radiating striae and strong serrations; snout naked; teeth of jaws in single row; dorsal spines X, rarely XI------------------------**Amphiprion** Bloch and Schneider

1*b*. Transverse scale rows less than 40; dorsal spines XII to XIV.

  2*a*. Teeth of jaws conical, biserial, outer row larger, more widely spaced than teeth of inner row, which are often villiform, usually forming a band near front of jaws; 2 or 3 short free spines at base of caudal fin above and below.

    3*a*. Suborbital margin, preopercle, and subopercle serrate; body ovate, its greatest depth 1.40 to 1.55 in standard length; angle of upper profile with lengthwise axis of body 60 to 80 degrees----**Dascyllus** Cuvier

    3*b*. Suborbital margin entire when free, usually poorly defined and sometimes not evident; subopercle entire, preopercle entire, or crenulate, sometimes finely serrate; body elliptical, its greatest depth 1.70 to 2.0; angle of anterior upper profile with lengthwide axis of body 40 to 50 degrees--**Chromis** Cuvier

  2*b*. Teeth of jaws not conical but compressed at tips, incisiform (at least at front of jaws) or long and slender with tips pointed or rounded, in one or two rows but second row close against outer and not forming a band; base of caudal without any free spines.

    4*a*. Preopercular margin serrate; suborbital serrate or entire.
Pomacentrus Lacepède

    4*b*. Preopercular margin entire, suborbital margin always entire.
Abudefduf Forskål

Genus AMPHIPRION Bloch and Schneider

Amphiprion Bloch and Schneider, Systema ichthyologiae . . . , p. 200, 1801 (type species, *Lutjanus ephippium* Bloch).—Schultz, Proc. U. S. Nat. Mus., vol. 103, pp. 187–201, pls. 9 and 10, 1953.

Prochilus (on Klein, 1775) Bleeker, Nat. Verh. Holl. Maatsch., No. 6, ser. 3, vol. 2, p. 20, 1877 (type species, *Lutjanus ephippium* Bloch).

Actinicola Fowler, Journ. Acad. Nat. Sci. Philadelphia, ser. 2, vol. 12, p. 533, 1904 (type species, *Lutjanus percula* Lacepède).

Phalerebus Whitley, Mem. Queensland Mus., vol. 9, pt. 3, p. 216, 1929 (type species, *Prochilus akallopisos* Bleeker).

Paramphiprion Wang, Contrib. Biol. Lab. Sci. Soc. China, vol. 15, zool. ser., No. 6, p. 89, 1941 (type species, *Paramphiprion hainanensis* Wang = *A. polymnus* (Linnaeus)).

Descriptions and analyses of species referable to the genus *Amphiprion* have been based on so few specimens, usually only one or two, that the problem of variability or constancy of the color pattern has been neglected. For most of the few hundred species, among more than 50 families studied in detail by Leonard P. Schultz, the basic color pattern has been observed to be fairly constant. It is of utmost importance in recognizing species, especially in the genus *Amphiprion.* Weber and de Beaufort (Fishes of the Indo-Australian Archipelago, vol. 8, pp. 330–348, 1940) recognized 8 species, whereas we have distinguished 15 species in the tropical Indo-Pacific, and there may be others recognizable when larger series are compared and additional characters studied.

During December 1953 Schultz had the good fortune to be able to study specimens of *Amphiprion* in the British Museum. As the result of these studies certain nomenclatorial changes are necessary in regard to his (1953) revision of this genus. Especially important was the discovery that his new *A. mauritiensis* is a synonym of *A. fusciventer* Bennett.

Fin ray counts were made on various species, including those examined by Schultz in the British Museum, are recorded in table 84.

Except for original descriptions no attempt was made to include all references to species referable to the genus *Amphiprion.* Whenever figures of species were found it has been possible to include these species in the synonymy, but most species descriptions are not in sufficient detail for them to be assigned without an examination of the specimen on which the records were based. The members of this genus normally live a commensal life in sea anemone.

In the revision by Schultz (1953) of *Amphiprion*, *A. latezonatus* Waite (pl. 79,A) was omitted. This valid species has been added to the following key after Schultz (1953, p. 189) modified in sections 6*a* and 6*b*.

KEY TO THE SPECIES OF AMPHIPRION

1*a*. A white band (sometimes indistinct) along middorsal line from snout to dorsal origin or beyond along base of dorsal fin; total pectoral rays 17 to

19; next to last dorsal spine about 1.3 to 1.5 in longest dorsal spine; no notable emargination in dorsal fin; scales on dorsal surface of head extend forward to a line between front of orbits.

2*a*. No vertical pale bars; dorsal rays about X,18 or 19; anal about II,12 or 13; pectoral 17 to 19________________________**A. akallopisos**[18] Bleeker

2*b*. A single vertical pale bar about 2 scales wide from nape to subopercle; dorsal rays about X,16; anal about II,12 or 13; pectoral 17.
A. perideraion Bleeker

1*b*. No white band along middorsal line.

3*a*. Caudal fin with pale or dusky roundish center posteriorly edged with black; outer edges of caudal fin white; second pale or white bar from rear of spiny dorsal fin to anus with a triangular anterior projection under depressed pectoral fin; tips of pelvics black; a broad white color bar on head and on caudal peduncle always present. Dorsal fin deeply indented at rear of spiny part, next to last dorsal spine contained three times in longest dorsal spine; scales on dorsal surface of head do not extend forward of nape; plate 81,D.
A. percula[19] (Lacepède)

3*b*. Color not as in *A. percula*.

4*a*. Central part of caudal fin black; outer edges of caudal fin broadly or narrowly edged with white; second pale bar, if present, without any projection anteriorly; pale bar on head present; next to last dorsal spine contained 1.2 to 2.0 times in longest dorsal spine; no notable emargination in dorsal fin.

5*a*. Second pale bar represented dorsally on body by an ovate white area that continues anterodistally on soft dorsal fin; this white area does not extend below midlengthwise axis of body and never to anus; first pale bar 10 to 12 scales wide; anal fin black, except distally edged with white; spiny dorsal black; pelvics black; pectoral pale, except basally it is blackish; next to last dorsal spine contained about 1.2 to 1.5 in longest dorsal spine;

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[18] *Amphiprion akallopisos* Bleeker, Nat. Tijdschr. Nederl.-Indië, vol. 4, p. 281, 1853 (type locality, Sumatra, type examined BM1862.2.28.68).—Schultz, Proc. U. S. Nat. Mus., vol. 103, pp. 190–191, pl. 9,A, 1953.

Prochilus akallopisus Bleeker, Atlas ichthyologique . . ., pl. 400, fig. 1, 1878.

[19] *Lutjanus percula* Lacepède, Histoire naturelle des poissons, vol. 4, pp. 194, 239, 240, 1802 (type locality, New Britain).

Amphiprion tunicatus Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 5, p. 399, pl. 132, fig. 2, 1830 (type locality, Vanicolo).—Lesson, Voyage . . . la *Coquille* . . . , zoologie, vol. 2, pt. 1, p. 192, pl. 25, fig. 3, 1830 (Port Praslin, New Ireland; Dorch, New Guinea).

Prochilus percula Bleeker, Atlas ichthyologique . . . , vol. 9, pl. 400, fig. 2, 1878.

Anthias polymna var. (non Linnaeus) Bloch, Naturgeschichte der ausländischen Fische, vol. 6, p. 103, pl. 316, fig. 3, 1792.

Amphiprion percula Günther, Journ. Mus. Godeffroy, vol. 15 (Fische der Südsee, pt.7), pl. 124, fig. A, 1881 (Samoan Islands).—Day, Fishes of India, vol. 2, p. 379, pl. 80, fig. 4, 1878 (Andamans).—Montalban, Bur. Sci. Manila Monog. 24, p. 14, pl. 2, fig. 2, 1928 (Philippine Islands).—Schultz, Proc. U. S. Nat. Mus., vol. 103, p. 191, pl. 9,C, 1953.

Actinicola percula Aoyagi, Coral fishes, Tokyo, pl. 37, fig. 2, 1943 (Kakure-Kumanomi); Biogeographica, Trans. Biogeogr. Soc. Japan, vol. 4, No. 1, p. 175, pl. 9, fig. 2, 1941 (Japan).

Amphiprion bicolor Castelnau, Proc. Zool. Acclim. Soc. Victoria, p. 92, 1873 (Port Darwin).

Actinicola bicolor (Castelnau) Whitley, Mem. Queensland Mus., vol. 9, pt. 3, p. 215, pl. 27, fig. 2, 1929 (Port Darwin).

no notable emargination in dorsal fin; scales on dorsal surface of head extend forward to a line between rear of orbits.
A. laticlavius [20] Cuvier and Valenciennes

5*b*. Second pale bar continuous from dorasl part of body to region of anus.

6*a*. (see also 6*b* and 6*c*) Second pale bar very broad about 16 to 18 scales wide at level of lateral line (its width there greater than width of second black bar at level of lateral line) from whence it continues ventrally becoming much broader, including the region from just behind the pelvic bases to the beginning of the last third of the base of anal fin; white bar across caudal peduncle present; basal ¾ of caudal fin blackish, distal ¼ whitish.
A. latezonatus [21] Waite

6*b*. Second pale color bar broad, about 7 to 14 scales wide at level of lateral line (its width there contained about 2 times in width of second black bar at level of lateral line) from whence it continues posterodorsally on soft dorsal fin, also ventrally it is about same width as at lateral line; pelvics dusky to blackish; spiny dorsal blackish; anal blackish at least basally; scales on dorsal surface of head extend forward to a line between rear of orbits.

7*a*. Caudal peduncle with broad white bar; pectoral fin pale distally, basally dusky_______**A. chrysogaster** Cuvier and Valenciennes

7*b*. Caudal peduncle black; no white bar; black coloration of posterior part of body continuous on central part of caudal fin; pectoral fin dusky________________________**A. polymnus** [22] (Linnaeus)

6*c*. Second pale bar narrow, about 2 to 6 scales wide at level of lateral line, its width there contained 5 or more times in width of second black bar at level of lateral line; caudal fin black, narrowly edged with white; anal fin pale to blackish; scales on dorsal surface of head extend forward to over rear half of pupil; pelvics and pectorals pale; soft dorsal black, edged with white.

8*a*. Second and third (peduncular) white bars about 2 or 3 scales wide, their width at level of lateral line contained 7 to 10 times in width of third black bar at level of lateral line; second white bar not extending to distal edge of dorsal fin, ending on basal half of last dorsal spine; posterodorsal part of body blackish; anterior and ventral parts of body pale; spiny dorsal light dusky.
A. tricinctus Schultz and Welander

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[20] *Amphiprion laticlavius* Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 5, p. 394, pl. 132, fig. 1, 1830 (type locality, New Guinea).—Schultz, Proc. U. S. Nat. Mus., vol. 103, p. 193, pl. 9,D, 1953.

Amphiprion bifasciatus (non Bloch) Montalban, Bur. Sci. Manila Monog. 24, p. 15, pl. 3, fig. 1, 1928 (Philippine Islands).

Amphiprion bifasciatus annamensis Chevy, Travaux Inst. Oceanogr. Indochine, Mem. 4, pt. 1, Poissons, p. 99, pl. 39, 1932 (type locality, Sud-Annam).

Prochilus bifasciatus (non Bloch) Bleeker, Atlas ichthyologique . . . , pl. 400, fig. 4, 1878.

Amphiprion polymnus (non Linnaeus) Aoyagi, Coral fishes, Tokyo, pl. 36, fig. 2, 1943 (Toaki-Kumanomi); Biogeographica, Trans. Biogeogr. Soc. Japan, vol. 4, No. 1, p. 173, pl. 12, fig. 4, 1941 (Japan).

Amphiprion unimaculatus (non Meuschen) Okada and Ikeda, Biogeographica, Trans. Biogeogr. Soc. Japan, vol. 3, No. 2, p. 202, fig. 28, 1939 (Itoman, Okinawa).

The following specimens were examined in the British Museum: BM1860.3.14.884, 2 specimens from India; BM1933.3.11.426 or 427, 1 specimen from the Philippines.

[21] *Amphiprion latezonatus* Waite, Rec. Australian Mus., vol. 3, No. 7, p. 201, pl. 34, 1900 (type locality, Lord Howe Island).

[22] *Perca polymna* Linnaeus, Systema naturae, ed. 10, p. 291, 1758 (type locality, "Indees").

Anthias bifasciatus Bloch, Naturgeschichte ausländischen Fische, vol. 6, p. 103, pl. 316, fig. 2, 1792.

8*b*. Second and third (peduncular) white bars 4 to 6 scales wide, their widths at level of lateral line contained from 4 to 6.5 times in width of third black bar at level of lateral line; second white bar extends into distal half of dorsal but not quite to the edge of that fin; dorsal and posterior half of body blackish; anteroventral part of body pale; spiny dorsal dusky to blackish; plate 79,D---------------------------- **A. fusciventer**[23] Bennett

4*b*. Caudal fin plain pale or plain dusky, no black central blotch edged with white posteriorly; first pale bar on head present.

9*a*. Second pale bar broad, about 7 to 13 scales wide at level of lateral line, and continuing to distal edge of spiny dorsal fin, thence posteriorly along distal edge of soft dorsal; caudal fin pale; caudal peduncle black, without the third pale bar, at least on adults; spiny dorsal, anal, and pelvic fins black; pectoral fin pale; next to last dorsal spine contained about 1.5 in longest dorsal spine; scales on dorsal surface of head extend forward to a line between rear of orbits. **A. sebae** Bleeker

9*b*. Second pale bar, if present, not continuing to distal edge of dorsal fin; next to last dorsal spine contained 0.8 to 1.2 in longest dorsal spine; scales on dorsal surface of head extend forward to lines between rear edge of orbits to center of pupil.

10*a*. First two pale bars typically present on adults.

11*a*. First two pale bars broad, each about 5 to 7 scales wide at level of lateral line; third (peduncular) pale bar represented by a white bar, posteriorly edged with darkish, or the dark body color on anterior part of caudal peduncle may end abruptly, the white continuing on caudal fin; spiny dorsal black, dusky, or pale; soft dorsal and anal fins pale to black; pelvics pale to black, sometimes edged with black anteriorly; pectoral pale; next to last dorsal spine about 1.2 in longest

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Prochilus bifasciatus Bleeker, Atlas ichthyologique . . ., vol. 9, pl. 400, fig. 5, 1878.

? *Amphiprion ocellaris* Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 5, p. 399, 1830 (type locality, Sumatra).

? *Amphiprion melanurus* Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 5, p. 400, 1830 (type locality, Sumatra).

Lutjanus jourdin Lacepède, Histoire naturelle des poissons, vol. 4, p. 191, 235, 1802 (type locality ,Amboina).

Coracinus seu *Sciaena unimaculata* Meuschen, Index Zoophyl. Gronow, Pisces, No. 227, 1781 (based on Gronow 1763).

Coracinus vittatus Gray, Catalogue of Fish collected and described by L. T. Gronow, p. 57, 1854 (on Gronow No. 227).

Amphiprion intermedius Schlegel and Muller, Verh. Nat. Gesch. Ned. Overz. Bezitt. Zool., p. 18, 1839–1841 (ref. copied).

Paramphiprion hainanensis Wang, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 15, No. 6, p. 89, 1941 (type locality, Hainan Island, China).

Amphiprion polymnus Schultz, Proc. U. S. Nat. Mus., vol. 103, p. 194, pl. 9,J, 1953.

Amphiprion polymnus (Linnaeus) has been confused almost since the day it was named. Weber and de Beaufort (Fishes of the Indo-Australian Archipelago, vol. 8, p. 344, 1940) discuss the confusion between *polymnus* and *bicinctus*, the former name having been used for the species currently called *bicinctus*. The following were examined in the British Museum: BM1852.4.21.144–144, from Amboina; 1871.7.20.121 from Manado.

[23] *Amphiprion fusciventer* Bennett, Proc. Comm. Zool. Soc. London, vol. 1, p. 165, 1831 (type locality, Mauritius; holotype BM1856.2.15.10).

Amphiprion mauritiensis Schultz, Proc. U. S. Nat. Mus., vol. 103, p. 196, pl. 9,I, 1953 (type locality, Mauritius).

dorsal spine------**A. xanthurus**[24] Cuvier and Valenciennes

11*b*. First two pale bars narrow, second usually narrower than first, the latter 3 to 4.5 scales wide and the first 3 to 6 scales wide at level of lateral line; caudal peduncle blackish, without third pale bar on adults, sometimes pale bar is present on young; dark color of caudal peduncle gradually fading into pale color of caudal fin; spiny dorsal pale to dusky, soft dorsal pale; anal fin pale; pectoral pale; pelvics pale, except anterior edge black; second from last dorsal spine contained from 1.0 to 1.2 times in longest dorsal spine.
A. bicinctus Rüppell

10*b*. First pale bar usually present on head, about 4 to 6 scales wide at level of lateral line; second pale bar lacking, except sometimes on small young specimens.

12*a*. Anal fin pale or partly pale; pelvics with some pale area.

13*a*. Anal fin pale, except distally edged with fine black line; pelvics pale, except anterior edge black; breast pale; dorsal spines X, soft dorsal rays usually 17; plate 80,A,C.
A. ephippium[25] (Bloch)

13*b*. Anal fin pale or distally pale with basal half (or less) dusky to blackish; pelvics pale distally and blackish ventrally, or inner rays pale and outer rays broadly blackish, except distal tips, which are pale; dorsal spines IX or X (more often IX than X), soft dorsal rays usually 17 or 18.
A. frenatus[26] Brevoort

12*b*. Anal and pelvic fins black, no pale areas anywhere; dorsal spines X, soft dorsal rays usually 17.
A. melanopus Bleeker

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[24] *Amphiprion xanthurus* Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 5, p. 402, 1830 (type locality, Ile de France).—Schultz, Proc. U. S. Nat. Mus., vol. 103, p. 198, pl. 9,G, 1953.

Amphiprion clarckii Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 9, p. 504, 1833 (amended spelling on Bennett).

Anthias clarkii Bennett, Fishes found upon the Coast of Ceylon. Ed. 2, p. 29, pl. 29, 1834 (type locality Ceylon).

Sparus milii Bory de St. Vincent, Dictionnaire classique d'histoire naturelle, vol. 17, p. 130, pl. 113, fig. 2, 1831 (type locality, China Sea).

Prochilus polymnus (non Linnaeus) Bleeker, Atlas ichthyologique . . ., vol. 9, pl. 400, figs. 7, 8, 1878.

Anthias polymna (non Linnaeus) Bloch, Naturgeschichte der ausländischen Fische, vol. 9, p. 89, pl. 316, fig. 1, 1792.

Amphiprion bicinctus (non Rüppell) Aoyagi, Coral fishes, Tokyo, pl. 37, fig. 1, 1943 (Kumanomi); Biogeographica, Trans. Biogeogr. Soc. Japan, vol. 4, No. 1, p. 169, pl. 9, fig. 1, 1941 (Japan).

Amphiprion polymnus (non Linnaeus) Okada and Ikeda, Biogeographica, Trans. Biogeogr. Soc. Japan, vol. 3, No. 2, p. 204, fig. 30, 1939 (Riu Kiu Islands).—Montalban, Bur. Sci. Manila Monog. 24, p. 10, pl. 1, fig. 1, 1928 (Philippine Islands).

Amphiprion chrysopterus Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 5, p. 401, 1830 (no locality given).

Amphiprion japonicus Temminck and Schlegel, Fauna Japonica, Pisces, p. 66, 1843 (type locality, Japan).

Amphiprion chrysargyrus Richardson, Rep. Fifteenth Meet. British Assoc. Adv. Sci., vol. 15, p. 254, 1846 (type locality, Seas of China and Japan).

Amphiprion boholensis Cartier, Verh. Phys.-Med. Ges. Würzburg, new ser., vol. 5, p. 96, 1874 (type locality, Bohol).

Amphiprion melonostolus Richardson, Ann. Mag. Nat. Hist., vol. 9, p. 390, 1842 (type locality, Depuch Island).

Amphiprion snyderi Ishikawa, Proc. Nat. Hist. Dep. Tokyo Imp. Mus., vol. 1, No. 1, p. 11, pl. 5, 1904 (type locality, Bonin Island).

TABLE 84.—*Fin ray counts recorded for certain species of* Amphiprion

	Dorsal									Anal					Pectoral (total rays)					
	IX	X	XI	14	15	16	17	18	19	II	12	13	14	15	16	17	18	19	20	21
ephippium north Australia, near Darwin	----	12	1	----	1	2	9	1	----	13	----	1	9	3	----	----	3	10	1	----
melanopus																				
Marshall Islands	----	10	1	----	1	2	8	----	----	6	----	1	5	----	----	----	----	6	5	----
Samoan, and Paumoto Islands	----	4	----	----	----	----	4	----	----	3	----	----	3	----	----	----	3	1	----	----
laticlavius	----	3	1	----	4	----	----	----	----	4	1	2	1	----	----	1	4	2	----	----
frenatus																				
Philippine Islands	23	10	----	----	----	2	19	12	----	16	----	----	16	----	----	----	5	23	2	----
Okinawa, and Japan	2	----	----	----	----	----	1	1	----	2	----	----	2	----	----	----	1	3	----	----
akallopisos	----	4	----	----	----	----	----	3	1	4	1	2	1	----	1	2	2	1	----	----
perideraion	----	5	----	----	----	5	----	----	----	5	1	3	1	----	----	5	----	2	----	----
chrysogaster	----	6	2	?1	1	2	5	----	----	8	----	1	7	----	----	----	1	3	8	2
bicinctus	----	8	1	----	1	5	3	----	----	9	----	2	6	1	----	----	1	7	3	1
fusciventer	----	10	1	----	----	2	8	1	----	11	----	1	9	1	----	----	----	----	12	10
tricinctus	----	1	----	----	----	----	1	----	----	1	----	----	1	----	----	----	----	----	1	----
latezonatus [1]	----	----	2	----	1	1	----	----	----	2	1	1	----	----	----	?1	----	----	2	----
xanthurus	----	12	1	----	4	8	1	----	----	12	----	5	5	1	----	----	----	7	7	----
percula	----	7	----	----	4	3	----	----	----	7	6	1	----	----	7	----	----	----	----	----
sebae	----	2	----	----	----	1	1	----	----	2	----	----	1	1	----	----	----	----	2	----

[1] Counts recorded by Waite and from a specimen in British Museum.

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[25] *Lutjanus ephippium* Bloch, Naturgeschichte der ausländischen fische, vol. 4, p. 121, 1790 (ref. not seen); Ichthyologie, Histoire naturelle des poissons, vol. 7, p. 93, pl. 250, fig. 2, 1792 (East Indies).

Amphiprion ephippium Day, Fishes of India, vol. 2, p. 378, pl. 80, fig. 1, 1878.—Schultz, Proc. U. S. Nat. Mus., vol. 103, pp. 199–200, pl. 10,B,C, 1953.

Amphiprion monofasciatus Thiollière, *in* Montrouzier, Essai sur la faune de l'Ile de Woodlark ou Moiou, Ann. Sci. Physic. Nat. Agri. Indust., vol. 8, p. 476, 1856 (type locality, Woodlark Island).

Amphiprion tricolor Günther, Catalogue of the fishes in the British Museum, vol. 4, p. 8, 1862 (type locality, Port Essington, South Australia; types examined, BM1844.1.13, BM1847.7.21.56, 1855.9.19.564–7).

Amphiprion rüppelli Castelnau, Proc. Zool. Acclim. Soc. Victoria, vol. 2, p. 91, 1873 (type locality, Port Darwin).

Amphiprion frenatus (non Brevoort) Day, Fishes of India, vol. 2, p. 378, pl. 80, fig. 2, 1878.

Prochilus ephippium Bleeker, Atlas ichthyologique . . . , vol. 9, pl. 401, figs. 1, 9, 1878.

Amphiprion rubrocinctus Richardson, Ann. Mag. Nat. Hist., vol. 9, p. 391, 1842 (type locality, Depuch Island [probably young]).

[26] *Amphiprion frenatus* Brevoort, Notes on some figures of Japanese fish, *in* U. S. Japan Exped. Nat. Hist., Washington, p. 263, pl. 6, fig. 4, 1856 (type locality, Lew Chew [Okinawa]).—Jordan and Snyder, Proc. U. S. Nat. Mus., vol. 24, p. 597, 1902.—Montalban, Bur. Sci. Manila Monog. 24, p. 12, pl. 2, fig. 1, 1927 (Philippine Islands).—Aoyagi, Biogeographica, Trans. Biogeogr. Soc. Japan, vol. 4, No. 1, p. 167, 1941 (Japan).—Okada and Ikeda, Biogeographica, Trans. Biogeogr. Soc. Japan, vol. 3, No. 2, p. 203, fig. 29, 1939 (Riu Kiu Islands).—Schultz, Proc. U. S. Nat. Mus., vol. 103, p. 201, pl. 10,D, 1953.

Prochilus polylepis Bleeker, Versl. Akad. Wet. Amsterdam, ser. 2, vol. 11, p. 135, 1877; Atlas ichthyologique . . . , vol. 9, pl. 401, fig. 6, 1878.

Amphiprion polymnus (non Linnaeus) Montalban, Bur. Sci. Manila Monog. 24, p. 10, pl. 1, fig. 1, 1928 (Philippines).

AMPHIPRION PERIDERAION Bleeker

PLATE 79,B

Amphiprion perideraion BLEEKER, Nat. Tijdschr. Nederl.-Indië, vol. 9, p. 437, 1855 (type locality, Obi Major).—MONTALBAN, Bur. Sci. Manila Monogr. 24, p. 16, pl. 4, fig. 1, 1928 (Philippine Islands).—SCHULTZ, Proc. U. S. Nat. Mus., vol. 103, p. 191, pl. 9,B, 1953.

Prochilus perideraion BLEEKER, Atlas ichthyologique . . ., pl. 400, fig. 1, 1878.

?*Amphiprion rosenbergi* BLEEKER, Act. Soc. Sci. Indo-Néerl., vol. 6, p. 16, 1859 (type locality, New Guinea); Atlas ichthyologique . . ., vol. 9, pl. 402, fig. 2, 1877.

Amphiprion nigripes REGAN, Trans. Linn. Soc. London, ser. 2, zool., vol. 12, p. 230, pl. 24, fig. 2, 1908 (type locality, Maldives, BM 1908.3.23.101, holotype examined).

SPECIMENS STUDIED

Bikini Atoll: 1 station, 1 specimen, 39.5 mm. in standard length.
Rongelap Atoll: 1 station, 1 specimen, 23 mm.

Description.—Dorsal fin rays X,15 or 16; anal II,13; pectorals ii,15; scale rows 50, with 5 or 6 rows between lateral line and base of dorsal, 19 between origin of anal and lateral line; perforated scales in lateral line 35.

Depth of body 2.14; length of head 3.3; both in standard length. Snout 3.43; eye 3.25; preorbital width 7.5; length of upper jaw 2.8; postorbital part of head (hind margin of eye to upper edge of gill opening) 2.8; interorbital width 3.25; depth of caudal peduncle 1.88; length of pectoral fin 1.29; length of pelvic fin 1.41; length of 3rd dorsal spine 2.61; length of middle caudal rays 1.02; all in length of head (tip of snout to tip of longest opercular spine). Angle of snout profile with lengthwise axis of body 61 degrees; snout profile convex.

Body oblong, preorbitals and suborbitals with strong spines, preopercle serrate, spines far apart; opercle and subopercle with strong radiating spines. Anterior spines of dorsal distinctly longer than posterior, so dorsal appears notched, soft dorsal and anal low, rounded, caudal rounded.

Color in alcohol.—Head and back light yellowish brown or reddish brown; sides and belly dirty grayish; a vertical chalky white line, narrower than eye but broader than pupil, extending from temporal region across anterior part of opercle, ending at lower margin of subopercle; a dark reddish brown median line from interorbital area to origin of spiny dorsal; all fins pale yellowish.

Remarks.—This species has been reported from the East Indies, Philippine Islands, and Palau Islands but not previously from Micronesia. It is best recognized by the narrow white band on the mid-dorsal line of head, beginning between front of eye and extending to dorsal origin, along with a narrow white vertical bar on rear of head behind eye. Four specimens were studied: USNM 141032, 141033 and 147129 from the Marshall Islands and Borneo, and MCZ 33409 from Amboina.

Schultz examined the type of *A. nigripes* in the British Museum and found the pectoral fin to have 19 rays, which number is 2 more than for western Pacific specimens of *perideraion*. Thus *A. nigripes* may be a valid species close to *A. perideraion*. The type has faded so that now it is light brown with an indistinct pale streak along base of dorsal fin, a broad pale band along midside, and probably one below, from lower edge of pectoral base to ventral edge of caudal peduncle. A series of specimens with distinct color patterns is needed to work out the relationship of these two forms.

AMPHIPRION CHRYSOGASTER Cuvier and Valenciennes

PLATE 81,C

Amphiprion chrysogaster CUVIER and VALENCIENNES, Histoire naturelle des poissons, vol. 5, p. 400, 1830 (type locality, Ile de France).—LESSON, Voyage . . . la *Coquille* . . ., zoologie, vol. 2, pt. 1, p. 191, pl. 28, fig. 3, 1830 (Ile de France).—SCHULTZ, Proc. U. S. Nat. Mus., vol. 103, p. 193, pl. 9,E, 1953.

Amphiprion percula (non Lacepède), OKADA and IKEDA, Biogeographica, Trans. Biogeogr. Soc. Japan, vol. 3, No. 2, p. 200, pl. 6, fig. 1, 1939 (Riu Kiu Islands).

Amphiprion trifasciatus CUVIER and VALENCIENNES, Histoire naturelle des poissons, vol. 5, p. 595, 1830 (type locality, Moluccas).

Prochilus bifasciatus (non Bloch) BLEEKER, Atlas ichthyologique . . ., vol. 9, pl. 400, fig. 6, 1878.

SPECIMENS STUDIED

Rongelap Atoll: 1 station, 1 specimen, 21.7 mm. in standard length.

Description.—Dorsal rays X,16; anal II,14; pectorals ii,18; scale rows from upper edge of gill opening to base of middle caudal rays 49, with 5 rows between lateral line and base of dorsal, 19 between lateral line and origin of anal.

Depth of body 2.0; length of head 3.0; both in standard length. Snout 4.24; eye 2.25; preorbital width 12.0; length of upper jaw 2.76; postorbital part of head 2.76; interorbital width 3.3; depth of caudal peduncle 2.05; length of pectoral fin 1.0; length of pelvics 0.76, length of third dorsal spine 1.8; length of middle caudal rays 0.9; all in length of head (tip of snout to tip of longest opercular spine). Depth of caudal peduncle in its length 1.6; angle of snout profile with lengthwise axis of body 45 degrees; snout profile convex.

Body oblong, suborbital entire, preopercle serrate on lower half of posterior margin, opercle with two diverging groups of spines, subopercle and posterior part of interopercle with spines; spiny dorsal fin with 9th spine shortest, so fin is deeply notched though spiny dorsal is connected with soft dorsal; soft dorsal, anal, and caudal rounded; pelvics long, one reaching to and one past origin of anal (perhaps a juvenile characteristic).

Color in alcohol.—Snout and chin pale yellowish white, body pale grayish brown; head and body with three black-bordered white transverse bars as wide as or wider than diameter of eye, first on posterior part of head running from nape across opercles just behind eye, second from the 9th dorsal spine and third soft dorsal ray to anus and origin of anal fin, and third, black-bordered on its anterior margin only, across the posterior ⅔ of caudal peduncle; second bar straight on its anterior margin, without forward projecting loop or point; spiny dorsal dusky brown except for last 2 spines, which are white; soft dorsal white on first 2 or 3 rays, rest of fin dusky brown; caudal fin white basally and distally, also on outer rays, rest of fin dusky brown; anal dusky blackish; one of pelvic fins pale, the other faintly dusky on tip; pectoral pale.

Remarks.—This species, with three broad white bars, has the central part of the caudal fin black and the outer edges white; the second white bar is continuous on the distal part of the soft dorsal fin.

We have examined (in USNM) 1 specimen each in lots from Mauritius (USNM 61690), the Marshall Islands (USNM 141034), and the Philippines (USNM 147127); (in MCZ) 3 specimens from Zanzibar, Africa, and also 1 from Apiang, Kingsmill Island (Marshalls), collected by Andrew Garrett; and (in BM), bearing the name *A. intermedius*, 1 specimen each from the following numbers: BM 1852.11.4.12, Molluccas; BM 1938.12.6.12, Mombassa; and BM 1862.2.25.1.9, from Dr. Bleeker's collection.

AMPHIPRION TRICINCTUS Schultz and Welander

PLATE 79,E

Amphiprion tricinctus SCHULTZ and WELANDER *in* Schultz, Proc. U. S. Nat. Mus., vol. 103, p. 195–196, pl. 9,H, 1953 (type locality, Bikini Atoll).

Amphiprion ephippium (non Bloch) var. *chrysopterus* (non Cuvier and Valenciennes) GÜNTHER, Journ. Mus. Godeffroy, vol. 15 (Fische der Sudsee, pt. 7), pp. 224–225, pl. 122, fig. C, 1881 (Kingsmill Island).

SPECIMENS STUDIED

Holotype USNM 152929, Bikini Atoll, Amen Island, lagoon, August 21, 1947, Univ. Washington, Staff of Applied Fisheries Laboratory, standard length 75 mm.

Description.—Dorsal fin rays X,17; anal II,14; pectoral ii,17,i—ii,16,ii; vertical scale rows from upper edge of gill opening to base of caudal fin 54, with 5 scales between lateral line and base of first soft dorsal ray, 20 between lateral line and anal origin; 36 pores in lateral line; predorsal scales 19 or 20; gill rakers 5+1+13.

Detailed measurements were made on the holotype and these data are expressed in thousandths of the standard length, 75 mm.: Greatest depth 560; length of head 272; snout 99; eye 95; preorbital width 35;

length from snout tip to rear edge of maxillary 101; postorbital length of head 147; interorbital width 100; depth of caudal peduncle 160; length of caudal peduncle from base of last anal ray to midbase of caudal fin 192; length of longest ray of pectoral 287, pelvic 313, upper caudal fin 307, lower lobe of caudal fin 300, spiny dorsal 160; length of next to last dorsal spine 160; width of white part of first pale bar, at level of lateral line, 73, of second 40, of last, or peduncular, 20.

Depth of body 1.7; head 3.4; both in standard length. Snout 3.2; eye 3.1; preorbital width 8.0; upper jaw 2.8; postorbital part of head 2.0; interorbital width 3.0; depth of caudal peduncle 1.8. Length of pectoral fin 1.0; pelvic 0.9; second dorsal spine 23; upper caudal rays 0.9 to 1.0; all in length of head. Depth of caudal peduncle in its length 1.2. Angle of upper profile of head with lengthwise axis of body about 50 degrees; profile of head convex.

Teeth in both jaws in a single row, nearly conical, a little compressed forward, pointed; interorbital space scaled forward to a line connecting between middle of pupils; 4 or 5 rows of scales on cheeks; gill cover with a few scales; scales occur part way out on all median fins; preorbital with 3 spines, and suborbital with 10 to 12 smaller spines.

Color in alcohol.—Background coloration of body from about fifth dorsal spine posteriorly and dorsally to midlengthwise axis of body blackish, the anteroventral part of body pale light brown, becoming paler ventrally; spiny dorsal dark brown, soft dorsal black, caudal fin black, except edged with white posteriorly; pectoral and pelvic fins pale or very light tan, anal pale or light tan and distally edged with a black line; first white bar from a little in front of dorsal origin just behind eye, ending on lower edge of subopercle; second white bar begins on last dorsal spine and base of first soft ray in lower third of fin, thence extends ventrally, meeting its fellow in narrow space between anal origin and anus; third white bar, about half width of second, or narrower than width of pupil, crosses caudal peduncle just in front of caudal fin base.

Remarks.—This species may be recognized by the narrowness of the three white bars, especially the second and third, the black caudal fin narrowly edged with white posteriorly.

Named *tricinctus* in reference to the three white bars.

AMPHIPRION SEBAE Bleeker

PLATE 81,B

Amphiprion sebae BLEEKER, Nat. Tijdsch. Nederl.-Indië, vol. 4, p. 478, 1853; (type locality, Batavia); Atlas ichthyologique . . ., vol. 9, pl. 400, fig. 9, 1878.—DAY, Fishes of India, vol. 2, p. 378, pl. 80, fig. 3, 1878 (Andamans).—OKADA and IKEDA, Biogeographica, Trans. Biogeogr. Soc. Japan, vol. 3, No. 2, p. 200, fig. 27, 1939 (Isigaki and Irimote Islands).—SCHULTZ, Proc. U. S. Nat. Mus. vol. 103, p. 197, pl. 9, F, 1953.

Amphiprion papuensis Macleay, Proc. Linnean Soc. New South Wales, vol. 8, no. 2, p. 271, 1883 (type locality, New Guinea).—Whitley, Mem. Queensland Mus., vol. 9, pt. 3, p. 210, pl. 27, fig. 1, 1929 (on holotype).

SPECIMENS STUDIED

Arno Atoll: 1 lot, 1 specimen, 16 mm. in standard length.

Description.—See table 84 for fin ray counts.

Color in alcohol.—This species is close to *A. xanthurus* but differs in having the second white bar continue to the distal edge of the dorsal fin, whereas in *A. xanthurus* the second white bar is interrupted by a blackish or brownish distal edge on the dorsal fin.

Remarks. As a result of his study of additional specimens of *Amphiprion*, and his study of the figure of *A. papuensis* by Whitley (1929), Schultz removes that species from the synonymy of *A. bicinctus* and now places it as a synonym of *A. sebae*.

In addition to those listed in his review the following were examined in the British Museum: BM 1844.2.21.54, Sumatra; BM 1887.11.11.265, Muscat, Arabia; BM 1888.11.6.34–35, East Coast of Madras; BM 1901.12.31.80, Maldives.

AMPHIPRION BICINCTUS Rüppell

Plate 79,C

Amphiprion bicinctus Rüppell, Atlas zu der Reise im nördlichen Afrika . . . Fische des Rothen Meers, p. 139, pl. 35, fig. 1, 1828 (type locality, Red Sea; 3 types examined BM 1845.10.29.89; and BM 1860.11.9.78–9).—Schultz, Proc. U. S. Nat. Mus., vol. 103, p. 199, pl. 10,A, 1953.

Amphiprion arion De Vis, Proc. Linnean Soc. New South Wales, vol. 8, p. 450, 1884 (type locality, South Seas).

SPECIMENS STUDIED

Bikini Atoll: 4 stations, 4 specimens, 25 to 99 mm. in standard length.

Description.—Dorsal fin rays X,16 or 17; anal II,14; pectoral ii,16 to 18; scale rows from upper edge of gill opening to base of middle caudal rays 52 to 55, with 6 or 7 between dorsal base and lateral line, 17 to 23 between lateral line and origin of anal; gill rakers on first arch, 7+1+13, total 21.

Depth of body 1.83 to 1.94; head 2.84 to 3.36; both in standard length. Snout 3.18 to 3.6; eye 2.81 to 3.43; preorbital width 6.57 to 10; length of upper jaw 2.68 to 3.21; postorbital part of head 2.09 to 2.88; interorbital width 2.58 to 3.21; depth of caudal peduncle 1.8 to 2.0; length of pectoral fin 1.1 to 1.17, of pelvic fin 1.1 to 1.3, of third dorsal spine 1.97 to 2.42, of upper caudal rays 0.78 to 0.96; all in length of head (tip of snout to tip of longest opercular spines).

Depth of caudal peduncle in its length 1.02 to 1.16; angle of snout profile with lengthwise axis of body 62 to 72 degrees.

Body deepest between origin of dorsal and insertion of pelvics; preorbital with 1 or 2 large spines, suborbitals serrate, preopercle entire on 99-mm. specimen, a few teeth wide apart on one 78 mm., and serrate on smallest (27 mm.); opercle, subopercle, and interopercle with long spines, free only near tips; dorsal spines subequal, the last not much shorter than second and third; soft dorsal and anal rounded; caudal with rays of upper angle longest pointed, caudal slightly forked, lower angle rounded.

Color in alcohol.—Lips, chin, lower part of cheeks, and breast pale whitish or yellow; interorbital light brown; body to middle of caudal peduncle dark brown; 2 bluish white, black-bordered transverse bands, the first from nape (where it may or may not join its fellow) ventrally across posterior margin of preopercle and anterior half of opercle to posterior tip of interopercle, this band as broad as diameter of eye at its broadest point, the second band only 3 scale rows in width, extending from between bases of 9th and 10th dorsal spines to about 2 scale rows anterior to anus, but not quite reaching anus, narrowing to a point ventrally; in 27-mm. specimen this band is narrow at base of 10th dorsal spine, where it commences, broadest on lateral line thence narrowing ventrally (it is also somewhat curved forward in the middle); caudal peduncle on anterior half light brown color gradually becoming lighter on posterior half; spiny dorsal dusky brown with narrow dark brown margin; soft dorsal dusky brown on basal ⅓, pale on distal ⅔; anal pale yellowish with narrow dark brown margin (in 27-mm. specimen anal entirely dusky brown); caudal dusky yellowish in large specimens, pale in small; pelvics yellowish or whitish in two large specimens, dusky brown in 27-mm. one; pectoral pale yellowish.

Remarks.—This species has the first two white bars but lacks the peduncular one; the anterior edges of the pelvics are black and the caudal fin is pale.

Six lots, containing 7 specimens, were studied: USNM 61679 from Suva, Fiji; 141030 and 141031 from the Marshall Islands; 3 uncataloged specimens, 1 from the Paumotus and 2 without data; also one from Bikini in the University of Washington collection.

Among these specimens, 4 adults, 82 to 99 mm. in standard length, have a pale anal fin, whereas 2, 26 and 27 mm. long, have a black anal and one, 25 mm. long, has a dusky anal fin. The caudal peduncle varies from pale dusky to black or brownish. The key gives the essential color pattern of this species.

AMPHIPRION MELANOPUS Bleeker

PLATE 80,D

Amphiprion melanopus BLEEKER, Nat. Tijdschr. Nederl.-Indië, vol. 3, p. 561, 1852 (type locality, Amboina).—SCHULTZ, Proc. U. S. Nat. Mus., vol. 103, p. 201, pl. 10,E, 1953.

Prochilus melanopus BLEEKER, Atlas ichthyologique . . ., pl. 401, fig. 7, 1878.

Prochilus macrostomus BLEEKER, Atlas ichthyologique . . ., pl. 401, fig. 5, 1878.

Amphiprion ephippium (non Bloch) GÜNTHER, Journ. Mus. Godeffroy, vol. 15 (Fische der Südsee, pt. 7), pl. 122, fig. D (var. *melanopus* on p. 225), 1881.

Amphiprion mccullochi WHITLEY, Mem. Queensland Mus., vol. 9, pt. 3, p. 213, 1929 (type locality, Lord Howe Island).

Amphiprion macrostoma (non Bleeker) CHEVY, Travaux Inst. Oceanogr. Indochine, Mem. 4, pt. 1, Poissons, p. 102, pl. 40, 1932 (Annam).

SPECIMENS STUDIED

Bikini Atoll: 3 stations, 8 specimens, 36 to 67 mm. in standard length.
Rongerik Atoll: 3 stations, 10 specimens, 30 to 72 mm.

Description.—Dorsal fin rays X,16 or 17 (rarely XI,15); anal II,13 or 14; pectoral ii,17 (rarely ii,18); scale rows from upper edge of gill opening to base of caudal rays 47 to 54 (usually 49 to 51), from base of dorsal to lateral line 4½ plus 2 on sheath, from lateral line to origin of anal 20 to 22; gill rakers 5+1+13.

Depth of body 1.7 to 1.9; head 3.0 to 3.2; both in standard length. Snout 2.7 to 4.3; eye 2.5 to 3.8; preorbital width 5.3 to 9.4; length of upper jaw 2.7 to 3.0; postorbital part of head 2.6 to 2.8; interorbital width 2.9 to 3.0; depth of caudal peduncle 1.8 to 1.9; length of pectoral fin 1.1 to 1.2; of pelvic fins 1.0 to 1.2, of second or third dorsal spines 2.2 to 2.5, of middle caudal rays 0.96 to 1.15; all in length of head (tip of snout to tip of longest opercular spine). Depth of caudal peduncle in its length 0.9 to 1.2; angle of snout profile with lengthwise axis of body 53 to 60 degrees, snout profile convex.

Body deepest between origin of dorsal and insertion of pelvic fins; preorbital, suborbital, and preopercle all serrate, opercle and subopercle with strong radiating spines; interopercle with spines only in posterior angle; spines of dorsal fin subequal, fin not deeply notched, soft dorsal and anal somewhat pointed at angle, caudal truncate, its outer angles rounded; scales on top of head occur forward to middle of interorbital area.

Color in alcohol.—Lips and chin yellowish or light brown, nape and interorbital area usually darker brown; a broad white band, slightly wider than eye diameter, extending from origin of spiny dorsal across anterior part of opercle and posterior part of preopercle to posterior part of interopercle, this band narrowly bordered by black; breast light tan; back and sides dark blackish brown, posterior half of caudal peduncle pale yellowish; spiny dorsal dusky, soft dorsal dusky basally, pale on distal half; caudal pale yellowish, anal blackish; pectorals pale whitish or yellowish; pelvics black.

Remarks.—This species is characterized by the single white bar on the head; plain black body; pale soft dorsal, caudal, and pectoral; but black pelvics and anal.

Genus DASCYLLUS Cuvier

Dascyllus Cuvier, Règne animal, ed. 2, vol. 2, p. 179, 1829 (type species, *Chaetodon aruanus* Linnaeus).

KEY TO SPECIES OF DASCYLLUS FROM THE NORTHERN MARSHALL ISLANDS AND ADJOINING REGIONS

1*a*. Dorsal rays XII,12, the second spine ⅔ the length of the third; head and body with 3 broad transverse black bands, first from origin of dorsal fin through eye to chin, second from about middle of spinous dorsal through base of pectorals to pelvics, third from anterior soft dorsal rays to anal rays, spaces between bands whitish or brownish; caudal fin entirely pale or slightly dusky basally; anal rays II,12 or 13; pectoral ii,15 or 16; gill rakers on first arch 23 or 24______________**D. aruanus** (Linnaeus)

1*b*. Dorsal rays XII,14 to 16, the second spine subequal to third, pectoral rays ii,18 or 19.

  2*a*. Body with a narrow brown vertical bar extending from origin of dorsal through pectoral base to base of pelvics (young specimens 14 to 16 mm. with a second vertical dark band from soft dorsal to anterior part of anal); general body color light yellowish, each scale with a narrow brown submarginal line; dorsal rays XII,14 to 16 (usually 15); anal II,13 or 14; gill rakers on first arch 27 or 28. **D. reticulatus** (Richardson)

  2*b*. Body without dark vertical bar but with a white spot on sides below 7th to 11th dorsal spines; sometimes with a small white nuchal spot (in young).

    3*a*. White spot on sides small or rarely absent, only slightly larger than pupil (in specimens of all sizes), situated in or just above 11th to 13th lateral line scales; general body color brown; each scale with dark submarginal line; dorsal rays XII,15; anal II,14; gill rakers on first arch 23 to 25______________________**D. trimaculatus** (Rüppell)

    3*b*. White spot on sides larger than eye (in specimens of all sizes); extending from base of dorsal to below lateral line, or in specimens under 25 mm. white spot usually a wedge-shaped bar narrowing ventrally; indistinct but still evident in large specimens (75 to 85 mm.); general body pattern reticulated in large specimens the scales with pale centers and dark submarginal line, blackish in smallest specimens; head usually very dark brown; dorsal rays XII,16 (rarely 15); anal II,15 or 16; gill rakers on first arch 25. (Not yet found in Marshall Islands.)__________________________________**D. albisella** Gill

DASCYLLUS ARUANUS (Linnaeus)

Plate 80,B

Chaetodon aruanus Linnaeus, Systema naturae, ed. 10, p. 275, 1758 (type locality, Indies).

SPECIMENS STUDIED

Bikini Atoll: 11 stations, 192 specimens, 7 to 35 mm. in standard length.
Eniwetok Atoll: 2 stations, 34 specimens, 23 to 60 mm.
Rongelap Atoll: 9 stations, 147 specimens, 10.5 to 54 mm.
Rongerik Atoll: 2 stations, 2 specimens, 37 to 40 mm.
Likiep Atoll: 1 lot, Univ. of Washington, 37 specimens, 23 to 58 mm.
Guam: 6 lots, 88 specimens, 20 to 53 mm.
Saipan: 2 lots, 30 specimens, 6.5 to 39 mm.

Description.—Dorsal fin rays XII,12; anal rays II,12 or 13; pectoral rays ii,15 or 16; scale rows from upper edge of gill opening to base of caudal rays 26 to 29, from base of dorsal to lateral line 4, from lateral line to origin of anal 10; gill rakers 6 or 7+1+15 to 17, totaling 23 or 24.

Depth of body 1.5 to 1.7; head 2.6 to 4.0; both in standard length. Snout 3.15 to 5.2; eye 2.4 to 3.0; preorbital width 6.6 to 6.7; upper jaw 3.2 to 3.4; postorbital part of head (hind margin of eye to upper edge of gill opening) 2.75 to 3.4; interorbital width 2.6 to 2.95; depth of caudal peduncle 1.9 to 2.1; length of pectoral fin 1.1 to 1.2, of pelvics 0.8 to 0.9, of 3rd dorsal spine 1.4 to 1.9, of upper caudal ray 0.8 to 1.0; all in length of head (tip of snout to posterior tip opercular spine). Depth of caudal peduncle in its length 1.0 to 1.9; angle of snout profile with lengthwise axis of body 63 to 67 degrees, upper profile convex.

Shape of body nearly round in young, oval in adults; preorbital, suborbital, preopercle, and subopercle serrate, opercle serrate near upper edge of gill opening and with a flat triangular spine; scales on snout anterior to nostrils; anterior rays of dorsal and anal longest, these fins angular; caudal with two free spines near base above and below, tips of lobes pointed, fin slightly forked.

Color in alcohol.—Head and body with three broad transverse black bands, the first from origin of dorsal through eye to chin, covering anterior part of head, except for yellowish interorbital area, lips blackish; the second from about middle of spinous dorsal through base of pectoral to pelvics; the third from anterior soft dorsal rays to anal rays; interspaces whitish, scales with white centers, brown margins, or entirely brown; anus black; spiny dorsal membranes black; tips of soft dorsal rays white, posterior rays of soft anal with white tips; caudal peduncle and caudal fin pale; pectoral rays pale, pelvics black.

Color when alive.—As described for preserved specimens, except that interorbital area and lips are grayish, spaces between first and second black bars silvery, base of caudal dusky.

Remarks.—*D. aruanus* should not be confused with *D. melanurus* Bleeker, which is illustrated in plate 81,E.

DASCYLLUS RETICULATUS (Richardson)

PLATE 82,B,C

Heliases reticulatus RICHARDSON, Rep. Fifteenth Meet. British Assoc. Adv. Sci., p. 245, 1846 (type locality, China, Japan).

Dascyllus marginatus FOWLER and BEAN (not Rüppell) U. S. Nat. Mus. Bull. 100, vol. 7, p. 17, 1928 (part, see remarks).

SPECIMENS STUDIED

Bikini Atoll: 2 stations, 11 specimens, 14 to 50 mm. in standard length.
Rongelap Atoll: 1 station, 1 specimen, 16 mm.
Likiep Atoll: 1 lot, Univ. Washington, 1 specimen, 25 mm.

Description.—Dorsal fin rays XII,14 to 16 (usually 15), anal II,13 or 14 (usually 14); pectoral ii, 18 or 19; scale rows from upper edge of gill opening to base of caudal rays 27 or 28, with 4 between base of dorsal and lateral line and 11 between lateral line and origin of anal; gill rakers 7 or 8+1+19 totaling 27 or 28.

Depth of body 1.5 to 1.6; head 2.7 to 3.3; both in standard length. Snout 3.5 to 3.9; eye 2.0 to 2.8; preorbital width 6.5 to 8.4; length of upper jaw 2.3 to 3.3; postorbital part of head (hind margin of eye to upper edge of gill opening) 2.5 to 3.0; interorbital width 2.5 to 3.9; depth of caudal peduncle 1.8 to 2.0; length of pectoral fin 0.97 to 1.1, of pelvics 0.8 to 0.9, of second dorsal spine 1.1 to 1.3, of upper caudal ray 0.8 to 0.9; all in length of head (tip of snout to hind margin of opercular membrane). Depth of caudal peduncle in its length 1.2 to 1.4; angle of snout profile with lengthwise axis of body 60 (young) to 76 (adult) degrees.

Shape of body oval-elliptical, preorbital and suborbital, preopercle finely serrated, opercle entire except a flat rounded spine on upper half, scales on snout to tip; first dorsal spine about ⅓ length of second, second spine somewhat curved, subequal with 3rd; teeth in outer row large, conical, widely spaced, inner row numerous fine, close-set.

Color in alcohol.—Ground color light yellowish brown, margins of scales darker brown on specimens 14 to 16 mm. with dark brown vertical bar, slightly broader than pupil running from origin of dorsal through base of pectorals to base of pelvics, a second vertical bar from soft dorsal to anterior part of anal; in specimens 20 to 50 mm. the posterior bar disappears leaving only anterior one which becomes paler and narrower; in 60 mm. specimens the anterior bar has also disappeared leaving only the reticulated pattern of the scales; in specimens of all sizes the spiny dorsal membrane is dark brown or blackish, base of soft dorsal dusky; anal dark brown on basal ⅓ or entirely dark brown or black; caudal dusky brown on basal ⅔; pelvics dark brown or black; pectorals pale; small round intensely black spot on upper edge of pectoral base not extending below the base of third ray (more distinct in specimens of 40 to 60 mm. than in smaller ones).

Remarks.—This species has been considered a synonym of *D. marginatus* (Rüppell, Atlas zu der Reise im nördlichen Afrika . . . Fische des rothen Meers, p. 38, pl. 8, fig. 2, 1828) by many authors (see Fowler, Mem. Bishop Mus., vol. 10, p. 306, 1928, Fowler and Bean, 1928, Montalban, Bur. Sci. Manila Monogr. 24, p. 24, 1927, Weber and Beaufort, Fishes of the Indo-Australian Archipelago, vol. 8, p. 465, 1940), but we conclude it is distinct (see pl. 81,A). We have carefully compared specimens from the Marshall and Philippine Islands with those of comparable size from Zanzibar, as well as with Rüppell's figure, and find them to be distinctly different in coloration. *D. marginatus* does not possess a dark vertical bar from dorsal origin through pectoral base to pelvic base, but instead has a large dark area (this may be lacking in some preserved specimens) covering entire nape and upper anterior sides downward and backward, fading behind pectoral, as clearly shown in Rüppell's figure though not in that of Cuvier and Valenciennes (Histoire naturelle des poissons, vol. 5, p. 437, pl. 133, 1830); pectoral base blackish except opposite lower 2 or 3 rays; furthermore, the general ground color of our specimens from Zanzibar is dark greenish brown as stated by Cuvier and Valenciennes and these specimens have small brown dots in middle of scale bases, the scales are not dark margined as in *D. reticulatus*.

Günther (Catalogue of the fishes in the British Museum, vol. 4, p. 14, 1862), who had specimens of *marginatus* from Rüppell's collection, noticed these differences and separated the two species, discussing one under *D. xanthosoma* Bleeker and including a discussion of *Heliases reticulatus* Richardson pointing out that the type specimens of the latter appear to be lost.

DASCYLLUS TRIMACULATUS (Rüppell)

Plate 82,A,E

Pomacentrus trimaculatus Rüppell, Atlas zu der Reise im nördlichen Afrika . . . Fische des rothen Meers, p. 39, pl. 8, fig. 3, 1828 (type locality, Massaua, Red Sea).

Dascyllus trimaculatus Kendall and Goldsborough, Mem. Mus. Comp. Zool. vol. 26, p. 298, 1911 (Jaluit, Marshall Islands).

SPECIMENS STUDIED

Rongelap Atoll: 1 station, 1 specimen, 57 mm. standard length.
Jaluit Atoll: *Albatross*, 1 specimen, 93 mm.
Arno Atoll: 1 lot, 1 specimen, 44 mm.
Guam: 1 lot, 1 specimen.

Description.—Dorsal fin rays XII,15; anal rays II,14; pectoral rays ii,18 or 19; scale rows, upper edge of gill opening to base of caudal rays 27 or 28, base of dorsal to lateral line 4; lateral line to origin of anal 10 or 11; gill rakers 7+1+15 to 17 totaling 23 to 25.

Depth of body 1.5; head 3.3; both in standard length. Snout 3.2 to 3.7; eye 2.4 to 2.9; preorbital width 6.2 to 7.6; upper jaw 3.0 to 3.3; postorbital part of head (hind margin of eye to upper edge of gill opening) 3.1 to 4.0; interorbital width 2.6 to 2.7; depth of caudal peduncle 1.6 to 1.8; length of pectoral fin 0.9 to 1.0, of pelvics 0.7 to 0.8, of second dorsal spine 1.2 to 1.3, of upper caudal rays 0.9; all in length of head (tip of snout to hind margin opercle). Depth of caudal peduncle in its length 1.0 to 1.15; angle of snout profile with lengthwise axis of body 78 to 80 degrees, snout profile slightly concave, interorbital convex, upper profile convex.

Shape of body oval in young, anterior profile much steeper in adults; preorbital, suborbital, and preopercle very finely serrated; opercle with broad flat triangular spine, its apex somewhat rounded, lower portion of opercle serrated; scales on snout to tip; first dorsal spine short, about half the length of second, second and third subequal, fifth or sixth dorsal and anal soft rays longest, soft dorsal outline somewhat pointed, anal less so; upper caudal lobe longer than lower, caudal fin slightly forked, caudal with two free spines, above and below near its base.

Color in alcohol.—Dark reddish brown to brownish black in large specimens, lips blackish, a small white spot about size of pupil on and just above eleventh to thirteenth lateral-line scales, this spot usually fainter and sometimes absent in large specimens; a white nuchal spot about same size as lateral spot sometimes present; spiny dorsal membranes and spines blackish; soft dorsal black where covered with scales, naked portion pale; pelvics, anal, and caudal entirely black; pectorals black basally, usually with small, very black spot just above upper edge of base, rays light tan, membranes hyaline.

Remarks.—Small specimens from the Philippines (19 to 39 mm.) were found to resemble the adults in having the white spot on the sides no larger than the pupil. The general body color was somewhat lighter, the scales having pale centers and dark brown margins, lips dark brown, fins as described in adults. These young of *D. trimaculatus* are not at all like the 3 specimens of comparable size in the type series of *D. albisella* Gill from Honolulu (USNM 6274), which have the head and breast paler than the back and the sides with a large white spot or bar 6 to 8 scales wide (much larger than the eye), and in which the scale margins are pale with bases dark.

Specimens of *trimaculatus* from the Marshall, Gilbert, Phoenix, and Samoan Islands have the naked part of the soft dorsal fin white or pale, whereas that area is dark brown or blackish in specimens from the East Indies to the Red Sea and Mauritius. We believe the specimens from the central tropical Pacific may represent a distinct subspecies. *D. albisella* from Honolulu, plate 82,D, is a distinct species. The detailed relationships of this group of species and subspecies remain to be worked out.

Genus CHROMIS Cuvier

Chromis Cuvier, Mem. Mus. Hist. Nat. Paris, vol. 1, p. 393, 1815 (type species, *Sparus chromis* Linnaeus).

KEY TO SPECIES OF CHROMIS FROM THE NORTHERN MARSHALL ISLANDS

1*a*. Preopercle finely serrate; scales of nape and back with small basal auxiliary scales; lower margin of suborbital partly free; upper parts dark brownish; sides and belly lighter; pelvics dusky, anterior portions soft dorsal and anal dark, posterior rays pale; outer caudal rays dusky, median rays pale; dorsal rays XII,11 or 12; anal II,11; pectoral ii,16.
C. lepidolepis Bleeker

1*b*. Preopercle entire or crenulate; no basal auxiliary scales on nape or back.

  2*a*. Soft dorsal and anal bases naked, outer row of teeth of lower jaw directed outward near symphysis; margin of suborbital obscure, hidden by scales; soft dorsal and anal membranes hyaline; outer caudal rays dusky; pelvics pale or slightly dusky; dorsal rays XII,10 (sometimes 9); anal II,10 (rarely II,9).

    3*a*. Pectoral rays usually ii,15 or 16 (occasionally 17); pectoral axil dusky but not completely black------**C. caeruleus** (Cuvier and Valenciennes)

    3*b*. Pectoral rays usually ii,17 or 18 (occasionally 16 or 19); pectoral axil black--------------------**C. atripectoralis** Welander and Schultz

  2*b*. Soft dorsal and anal bases scaled; outer row of teeth of lower jaw not directed outward.

    4*a*. Pectoral base with a large black spot, pectoral axil black; suborbital margin free, distinct; caudal peduncle and caudal fin pale yellowish; pelvics black.

      5*a*. Head and body dark purplish brown; caudal peduncle abruptly pale, soft dorsal dark brown on bases of first 2 or 3 rays, the rest entirely pale or white; dorsal rays XII,12; anal II,12; pectorals ii,15; tubular scales in upper part of lateral line 17 or 18; gill rakers $8+1+19=28$--------------------**C. dimidiatus** (Klunzinger)

      5*b*. Head light yellowish brown, back, sides, and caudal peduncle, light purplish brown; soft dorsal with first four rays entirely brown, the rest dark basally, pale distally; dorsal rays XII,13; anal II,12 to 14 (usually 13); pectorals ii,14 or 15 (usually 15); tubular scales in upper part of lateral line 15 or 16 (usually 15); gill rakers 8 or $9+1+21$ or $22=31$ or 32---------------**C. leucurus** Gilbert

    4*b*. Pectoral base without large black spot; pectoral axil pale; suborbital adnate, its margin not evident; broad distinct brown lengthwise band on upper and lower caudal rays; pelvics pale; dorsal rays XII,11; anal II,11; pectorals ii,15 or 16----**C. ternatensis** (Bleeker)

CHROMIS LEPIDOLEPIS Bleeker

Plate 83,A

Chromis lepidolepis Bleeker, Versl. Akad. Wet. Amsterdam, ser. 2, vol. 10 (1876), p. 389, 1877 (type locality, Timor).

Dascyllus pomacentroides Kendall and Goldsborough, Mem. Mus. Comp. Zool., vol. 26, p. 298, pl. 5, fig. 1, 1911 (type locality, Taritari, Gilbert Islands, holotype USNM 65812 studied).

Serrichromis pomacentroides Fowler, U. S. Nat. Mus. Bull. 100, vol. 14, part 2, pp. 77, 78, 1943.

SPECIMENS STUDIED

Bikini Atoll: 1 station, 2 specimens, 50 to 55 mm. in standard length; Univ. of Washington, 1 lot, 1 specimen, 46 mm.

Description.—Dorsal fin rays XII,11 or 12; anal rays II,11; pectoral rays ii,16; transverse scale rows from upper edge of gill opening to base of caudal rays 27, with 2 between lateral line and origin of dorsal, 9 between lateral line and origin of anal; upper part of lateral line with 16 or 17 tubular scales; gill rakers 8+1+20, totaling 29.

Depth of body 2.1; length of head 3.3 to 3.4; both in standard length. Snout 3.9 to 4.1; eye 2.7; least preorbital width 12.3 to 12.5; length of upper jaw 2.9 to 3.0; postorbital part of head (hind margin of eye to upper edge of gill opening) 2.8 to 3.0; interorbital width 2.8 to 3.0; depth of caudal peduncle 2.0 to 2.1; length of pectoral fin 1.1 to 1.2, of pelvic fin 0.8 to 0.9, of 3rd dorsal spine 1.8 to 2.0, of upper caudal rays 0.7 to 0.80, of lower caudal rays 0.8 to 0.9; all in length of head (tip of snout to posterior margin of opercular membrane). Depth of caudal peduncle in its length 1.4 to 1.5; angle of upper profile with lengthwise axis of body 43 degrees.

Teeth of jaws in 2 rows, those of outer row heavy, conical, widely spaced, those near median line enlarged, inner row teeth smaller; snout short, scaled to a point just anterior to nostrils; preorbital and suborbital scaled, the latter with lower margin partly free; preopercle with posterior margin finely serrate, lower margin entire; some scales of body particularly of nape and upper anterior sides with small basal scales, bases of soft dorsal and anal scaled, soft part of these fins angular; caudal lobes pointed.

Color in alcohol.—Lips dusky, upper part of head dark reddish brown, lower part paler; back and upper sides reddish brown, lower sides paler yellowish brown with faint lengthwise reddish brown lines following scale rows; spiny dorsal dusky, edges of membranes black; anterior dorsal rays blackish, posterior rays dusky, membranes clear; soft anal with anterior half black, posterior half pale; outer caudal rays dark brown or blackish; middle caudal rays lighter but dusky;

pelvic rays grayish, membranes clear, pectoral similarly colored, base of pectoral dark reddish brown, minute black spot on base of upper ray.

Remarks.—A careful examination of the type of *Dascyllus pomacentroides* reveals 2 or 3 scales, with small basal scales. Most of the scales are missing from the nape, back and anterior sides. The type has the same number of fin rays as specimens of *Chromis lepidolepis* from the Philippines and as two specimens from Bikini; also, it has similar jaw teeth, serrated preopercle, body and fin shape, and coloration (although faded).

Fowler has made *Dascyllus pomacentroides* the type of a new genus *Serrichromis*, "distinguished by its serrated preopercle, strong dentition in combination with other characters." These characters, held in common with *C. lepidolepis*, certainly serve to separate this species from others of the genus *Chromis*, but Fowler has already proposed the subgeneric name *Lepidochromis* Fowler and Bean (U. S. Nat. Mus. Bull. 100, vol. 7, p. 58, 1928), for this species.

We propose, in spite of the differences noted above, to leave this species as a subgenus of *Chromis*, at least for the present, because its jaw teeth, though heavier, are definitely of the same kind as the genus *Chromis*, as are its oblique mouth, with its long upper jaw, and its general body shape.

CHROMIS CAERULEUS (Cuvier and Valenciennes)

PLATE 84,B

Heliases caeruleus CUVIER and VALENCIENNES, Histoire naturelle des poissons, vol. 5, p. 497, 1830 (type locality, New Guinea; Ulea).

Heliases lepisurus CUVIER and VALENCIENNES, Histoire naturelle des poissons, vol. 5, p. 498, 1830 (type locality, New Guinea).

Heliases frenatus CUVIER and VALENCIENNES, Histoire naturelle des poissons, vol. 5, p. 498, 1830 (type locality, Guam).—SAUVAGE, Histoire naturelle des poissons, *in* Grandidier, Histoire . . . de Madagascar vol. 16, p. 436, pl. 28, fig. 1, 1887 (Madagascar).

Chromis lepisurus BLEEKER, Atlas ichthyologique . . . , vol. 9, pl. 403, fig. 7, 1877; Nat. Verh. Holl. Maatsch. Wetensch., vol. 2, No. 6, p. 164, 1877 (East Indies; Zanzibar; Andamans; Guam; Ulea).

Heliastes lepidurus GÜNTHER, Catalogue of the fishes in the British Museum, vol. 4, p. 63, 1862 (type locality, Amboina, emended spelling for *H. lepisurus* Cuvier and Valenciennes).—DAY, Fishes of India, vol. 2, p. 389, pl. 82, fig. 1, 1877 (Andamans).—GÜNTHER, Journ. Mus. Godeffroy, vol. 15 (Fische der Südsee, pt. 7), p. 238 (in part), pl. 128, fig. D, 1881.

Glyphisodon anabatoides DAY (non Bleeker), Proc. Zool. Soc. London, p. 696, 1870.

Glyphisodon bandanensis BLEEKER, Nat. Tijdschr. Nederl.-Indië, vol. 2, p. 248, 1851 (type locality, Neira; Banda).

Chromis caeruleus (in part), JORDAN and SEALE, Bull. U. S. Bur. Fish. vol. 25 (1905), p. 290, 1906 (Samoan Islands; in a letter cited on p. 291, to Dr. Jordan from Dr. Vaillant, who examined the types of *caeruleus*, *frenatus*, and *lepisurus*, all three are referred to a single species by him).—AOYAGI, Biogeographica, Trans. Biogeogr. Soc. Japan, vol. 4, No. 1, p. 186, fig. 14, 1941 (Japan).

SPECIMENS STUDIED

Bikini Atoll: 8 stations, 132 specimens, 11 to 75 mm. in standard length.
Eniwetok Atoll: 2 stations, 21 specimens, 29 to 63 mm.
Rongerik Atoll: 2 stations, 9 specimens, 36 to 56 mm.
Rongelap Atoll: 4 stations, 117 specimens, 10 to 68 mm.
Kwajalein Atoll: 1 specimen, 34 mm.
Guam: 3 lots, 121 specimens, 28 to 59 mm.
Saipan: 3 lots, 170 specimens, 8 to 22 mm.

The following lots were distributed to other museums before the new species was sorted out, and thus may contain specimens of *atripectoralis:*

Bikini Atoll: Reer Island, northwest side, lagoon reef, August 12, S-46-332, Herald and Brock, 2 specimens, 45 and 46 mm.; Cherry Island, ocean reef, August 15, S-46-361, Herald, 4 specimens, 44 to 75 mm.; Bikini-Amen reef, July 21, 1947, S-46-442, Brock, Hiatt and Schultz, 2 specimens, 48 to 54 mm.

Rongelap Atoll: Eniaetok Island, north end, lagoon reef, June 17, S-48-215, Schultz, 3 specimens, 38 to 53 mm.; Mellu Island, lagoon reef, June 19, S-46-220, Schultz and Herald, 3 specimens, 26.5 to 33 mm.; Eniaetok Island, north end, Lomuilal Island, lagoon reef, August 1, S-46-306, Herald, 3 specimens, 48.5 to 56 mm.

Rongerik Atoll: Bock Pass, dip net under light at night, June 2, 1946, N-3, Marr, 1 specimen, 41 mm.

Description.—Dorsal fin rays XII,10 (sometimes XII,9); anal II,10 (rarely II,9); pectoral ii,15 to 17 (usually 16); transverse scale rows from upper edge of gill opening to base of caudal rays 25 to 27 (usually 26), with 2 between lateral line and origin of dorsal, 9 between lateral line and origin of anal; upper part of lateral line with 15 or 16 tubular scales; gill rakers 7 to 9+1+21 to 24, totaling 30 to 32.

Depth of body 2.0 to 2.3; length of head 3.0 to 3.3; both in standard length. Snout 3.3 to 4.1; eye 2.6 to 3.5; preorbital width 6.7 to 7.5; length of upper jaw 2.1 to 2.4; postorbital part of head (hind margin of eye to upper edge of gill opening) 2.3 to 2.4; interorbital width 2.7 to 2.9; depth of caudal peduncle 2.2 to 2.3; length of pectoral fin 1.1 to 1.3; of pelvic fin 1.2 to 1.5, of second dorsal spine 1.9 to 2.0, of upper caudal rays 0.6 to 1.0, of lower caudal rays 0.7 to 1.1; all in length of head (tip of snout to posterior margin of opercular membrane). Depth of caudal peduncle in its length 1.2 to 1.3; angle of upper profile with lengthwise axis of body 31 to 47 degrees, profile straight to convex.

Teeth of jaws conical, widely spaced, an outer row of enlarged teeth in lower jaw, these projecting anteriorly near symphysis, a few flaring outward and curving somewhat posteriorly at sides of symphysis; inner teeth minute, few in number and in a single row in upper jaw, forming small patches of very minute teeth on either side of symphysis in lower jaw; snout scaled to tip, line from eye, including nostril and along upper edge of preorbital, naked; preorbital and suborbital scaled, lower margin of latter almost entirely obscured;

preopercle produced at angle, its posterior margin entire, with some irregular crenulations observable at angle in many specimens; no scales on bases of soft dorsal and anal; upper and lower caudal rays filamentous, 3 free spines on upper and lower caudal base; profile angle (measured with one side of angle along closed lower jaw to snout and the other side from snout to nape above gill opening) 75 to 83 degrees.

Color in alcohol.—Head and upper half of body bluish gray or brownish; lower sides and belly lighter, pale to silvery; along naked area from eye just under nostril toward middle of snout, a narrow dark to bluish line; lips dusky, especially at tips of jaws; iris faintly bluish; spiny dorsal membrane dusky basally, dusky to clear hyaline distally, spines dusky; soft dorsal and anal rays dusky, membranes dusky to clear, hyaline; upper and lower caudal rays brownish, middle rays dusky basally, pale distally; pelvics pale to dusky; pectorals pale except at base, where upper rays are usually dusky, axil of pectoral pale to dusky, never dense black.

Color when alive.—Dorsally bright bluish green, ventrally paler or grayish white; a blue-green line across upper part of eye to snout and a second line from anterior margin of eye just below nostril to snout; upper and lower caudal rays greenish, outer margin dusky, middle rays greenish on scaled portion; small round blue-green spots sometimes present on head and on each scale of body.

CHROMIS ATRIPECTORALIS Welander and Schultz

PLATE 85,A

Chromis atripectoralis WELANDER and SCHULTZ, Journ. Washington Acad. Sci. vol. 41, No. 3, p. 107, fig. 1, 1951 (type locality, central and western tropical Pacific).

Chromis caeruleus (in part), JORDAN and SEALE, Bull. U. S. Bur. Fish., vol. 25 (1905), p. 290, ? pl. 46, fig. 1, 1906 (Samoan Islands; color descriptions for specimens numbered 2, 4, and 6, with pectoral axil black, appear to be this species).—MONTALBAN, Bur. Sci. Manila Monog. 24, p. 35, pl. 8, fig. 2, 1927 (Philippine Islands).

Heliastes lepidurus GÜNTHER, Journ. Mus. Godeffroy, vol. 15 (Fische der Südsee, pt. 7), p. 238 (in part), pl. 128, fig. C, 1881.

SPECIMENS STUDIED

The following list includes holotype, paratypes, and nontype specimens:

Bikini Atoll: 2 stations, 25 specimens, 22 to 76 mm. in standard length. Univ. Washington, 5 lots, 21 specimens, 36 to 83 mm.

Rongerik Atoll: 2 stations, 13 specimens, 23 to 49 mm., 1 lot, Univ. Washington, 1 specimen, 28 mm.

Rongelap Atoll: 2 stations, 44 specimens, 30 to 70 mm.

Eniwetok Atoll: 1 station, 8 specimens, 28 to 67 mm., 2 lots, Univ. Washington, 2 specimens 47 to 53 mm.

Likiep Atoll: Univ. Washington, 1 lot, 11 specimens, 27 to 52 mm.

Guam: 3 lots, 85 specimens, 9 to 60 mm.

Description.—Dorsal fin rays XII,9 or 10 (usually 10); anal II,9 or 10 (usually 10); pectorals ii,16 to 19 (usually 17 or 18); transverse scale rows from upper edge of gill opening to base of caudal rays 24 to 27, with 2 between lateral line and origin of dorsal, 9 between lateral line and origin of anal; dorsal lateral line with 15 or 16 tubular scales; gill rakers 6 to 9+1+19 to 22, totaling 28 to 31.

Depth of body 2.0 to 2.2; length of head 3.1 to 3.6; both in standard length. Snout 3.5 to 4.0; eye 2.8 to 3.3; preorbital width 7.0 to 8.0; length of upper jaw 2.5 to 2.9; postorbital part of head (hind margin of eye to upper edge of gill opening) 2.2 to 2.5; interorbital width 2.9 to 3.1; depth of caudal peduncle 2.0 to 2.3; length of pectoral fin 1.2 to 1.3, of pelvic fin 1.2 to 1.3, of second dorsal spine 2.0 to 2.3, of upper caudal rays 0.6 to 1.0, of lower caudal rays 0.7 to 0.9, all in length of head (tip of snout to posterior margin of opercular membrane). Depth of caudal peduncle in its length 1.1 to 1.4; angle of upper profile with lengthwise axis of body 33 to 48 degrees, profile straight to convex.

Teeth of jaws conical, widely spaced, an outer row of enlarged teeth, in lower jaw projecting anteriorly near symphysis, a few teeth at sides near tip of lower jaw curve out posteriorly; inner teeth minute and in single row in upper jaws, forming small patches of very minute teeth on either side of symphysis in lower jaw; snout scaled to tip, line from eye, including nostril and along upper edge of preorbital, naked; pre- and sub-orbitals scaled, lower margin of latter almost entirely obscured; preopercle produced at angle, its posterior margin entire with some irregular crenulations observable at angle in many specimens; no scales on bases of soft dorsal and anal; upper and lower caudal rays filamentous, 3 free spines on upper and lower caudal base; profile angle, measured with one side of angle lying along closed lower jaw to tip of snout and the other side from snout to nape directly above gill opening, 80 to 96 degrees.

Color in alcohol.—Head and upper half of body bluish gray to brown; lower sides and belly lighter, pale to silvery; a narrow dark to bluish line from eye along naked area just under nostril toward middle of snout; iris faintly bluish; spiny dorsal membrane more or less dusky, this sometimes accentuated basally and distally, spines dusky; lips, especially at tips of jaws, dusky to black; soft dorsal and anal rays dusky, membranes lighter; upper and lower caudal rays brownish, middle rays dusky basally, pale distally; pelvics pale to dusky; pectorals pale except at base, where upper rays are dusky to blackish, axil of pectoral with large black blotch, this broadest on dorsal portion and usually not extending to lower rays; in young of less than 40 mm. standard length axil of pectoral dusky to black.

Color when alive.—Top of head and back bright bluish green; a narrow blue-green line across upper part of eye to snout and a second line from anterior margin of eye just below nostril to snout; lower half of head, sides of body, and belly pure white or grayish white; spiny dorsal smoky purplish; soft dorsal and anal rays dusky, membranes faintly yellowish; upper and lower caudal rays greenish, outer margins blackish, middle rays greenish on scaled portion, yellowish on naked portion, pelvics grayish; pectorals clear hyaline, except upper ray dusky.

Remarks.—This species may be differentiated from *C. caeruleus* on the basis of two striking characters: The black axil of the pectoral fin and the greater number of branched pectoral rays (see table 86), usually 17 or 18 in *atripectoralis*, whereas *caeruleus* usually has 15 or 16. The pectoral axil of *caeruleus* is pigmented with black dots that form a dusky area only along the dorsal part, thence fading ventrally, where no pigment cells occur, or only a few, whereas *atripectoralis* has a black axil and the individual black pigment cells are not isolated when viewed under magnification, the outer edge of this black axil sharply contrasts with the pale distal part of the axil. On specimens shorter than about 30 mm. in standard length the axil is not quite as black as in longer specimens. We note that the distal margin of the spiny dorsal fin of *atripectoralis* may have a dusky to blackish line whereas that of *caeruleus* is pale.

Although most of the descriptions in the literature for these blue-green damsel fishes fail to mention the colorations of the pectoral axil; some do, and show the spiny dorsal fin with a dark margin. We have listed a few such references in the synonymy.

Fowler and Bean (U. S. Nat. Mus. Bull. 100, vol. 7, pp. 31, 61, 1928) have proposed the subgenus *Hoplochromis* for *C. caeruleus*, characterized by having the "front edge of lower jaw with 6 short conic teeth flaring outward."

Tables 85 and 86 present detailed measurements and counts for certain species of *Chromis* related to *C. atripectoralis*.

CHROMIS DIMIDIATUS (Klunzinger)

Plate 83,B

Heliastes dimidiatus Klunzinger, Verh. Zool.-Bot. Ges. Wein, vol. 21, p. 529, 1871 (type locality, Red Sea).

Chromis dimidiatus margaritifer Fowler, Proc. Acad. Nat. Sci. Philadelphia, vol. 98, p. 140, figs. 9, 10, 1946 (type locality, Riu Kiu Islands).

SPECIMENS STUDIED

Bikini Atoll: Arji Island, 100 yards off shore, lagoon coral area at depths from 0 to 40 feet, poison and spear, Aug. 7, S–46–308, Brock and Herald, 4 specimens, 27.5 to 47.5 mm.

TABLE 85.—*Measurements, in thousandths of the standard length, for three species of* Chromis

Character	*leucurus* (Bikini Atoll)			*caeruleus* (Bikini Atoll)			*atripectoralis*				
							Bikini Atoll				Guam
							Paratype	Paratype	Paratype	Holotype	Paratype
Standard length in mm	60.5	31	45.8	30.2	45.0	58.7	31.1	46.1	52.3	67	41.5
Depth of body	590	500	542	464	449	477	462	475	470	455	458
Length of head	297	316	310	301	298	303	309	293	311	314	313
Length of snout	73	68	72	79	84	83	73	76	79	87	80
Diameter of eye	104	129	112	96	96	85	112	93	101	100	113
Least preorbital width	29	29	28	20	24	29	29	24	36	31	31
Length of upper jaw	89	103	101	99	113	114	116	117	122	112	120
Postorbital part of head	122	123	125	129	120	126	119	121	127	136	137
Interorbital width	114	113	114	86	84	99	103	91	105	90	101
Least depth of caudal peduncle	164	155	158	129	122	131	138	143	137	130	142
Length of pectoral fin	345	359	365	242	249	266	270	269	249	251	265
Length of pelvic fin	366	426	393	268	240	267	251	256	281	230	251
Length of 3rd to 6th dorsal spines	137	184	-------	162	140	150	132	154	135	149	147
Length of upper caudal rays	-------	-------	627	331	-------	341	-------	360	-------	298	362
Length of lower caudal rays	484	-------	568	331	-------	310	338	321	324	403	386
Length of caudal peduncle	184	206	190	145	160	170	179	182	183	221	222

Description.—Dorsal fin rays XII,12; anal II,12; pectoral ii,15; tranverse scale rows 27 or 28 from upper edge of gill opening to base of caudal rays, 3 between lateral line and origin of dorsal; upper part of lateral line with 17 or 18 tubular scales; 9 between lateral line and origin of anal; gill rakers 8+1+19, totaling 28. Additional counts are recorded in table 87.

Depth of body 1.9 to 2.0; length of head 3.1 to 3.2; both in standard length. Snout 4.0 to 4.6; eye 2.4 to 2.8; preorbital width 10.7 to 12.4; length of upper jaw 3.1 to 3.2; postorbital part of head (hind margin of eye to upper edge of gill opening) 2.6 to 3.2; interorbital width 3.0 to 3.1; depth of caudal peduncle 1.9 to 2.0; length of pectoral fin 0.9 to 1.0, of pelvic fins 0.8 to 0.9, of 5th dorsal spine 1.7 to 1.9; of upper caudal rays 0.5 to 0.6, of lower caudal rays 0.5 to 0.7; all in length of head (tip of snout to posterior margin of opercular membrane). Depth of caudal peduncle in its length 1.1 to 1.3, angle of snout profile with lengthwise axis of body 43 degrees.

Teeth of jaws biserial; females with teeth of outer row enlarged, widely spaced, conical, inner row smaller, conical, in 3 irregular rows near median line, single row laterally; males with teeth of outer row small, even, close-set, conical, inner row minute, in single row, close

TABLE 86.—*Counts on two species of* Chromis *for various Indo-Pacific localities*

	Fin rays												Vertical scale rows crossing lateral line				Gill rakers on first arch										
	Dorsal			Anal			Pectoral										Above angle				At angle	Below angle					
	XII	9	10	II	9	10	ii	15	16	17	18	19	24	25	26	27	6	7	8	9	1	19	20	21	22	23	24
caeruleus																											
Marshall Islands	18	3	15	18	----	18	42	8	32	2	----	----	----	3	19	8	----	4	7	1	12	----	----	5	6	1	----
Marianas Islands	----	----	----	----	----	----	22	3	15	4	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Philippine Islands	----	----	----	----	----	----	16	2	13	1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Phoenix and Samoan Islands	6	1	5	6	1	5	3	1	2	----	----	----	----	----	----	----	----	----	5	1	6	----	----	2	2	1	1
Total	24	4	20	24	1	23	83	14	62	7	----	----	----	3	19	8	----	4	12	2	18	----	----	7	8	2	1
atripectoralis																											
Marshall Islands	16	1	15	16	1	15	31	----	2	11	21	1	4	10	10	7	1	3	10	1	15	1	4	7	3	----	----
Marianas Islands	----	----	----	----	----	----	21	----	1	4	16	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Philippine Islands	----	----	----	----	----	----	16	----	----	8	8	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Phoenix and Samoan Islands	4	----	4	4	2	2	5	----	----	----	4	1	----	1	----	1	----	----	----	----	----	----	----	----	----	----	----
Total	20	1	19	20	3	17	73	----	3	23	49	2	4	11	10	8	1	3	10	1	15	1	4	7	3	----	----

to teeth of outer row. Snout scaled to nostrils, which are close to tip, preorbital and suborbital scaled; the latter narrow, with margin free; margin of preopercle slightly crenulate; 5th to 7th dorsal spines longest, subequal; soft dorsal and anal pointed, rays of caudal lobes filamentous; pelvics with outer ray filamentous reaching to first anal ray; pectorals angular.

Color in alcohol.—Lips gray, head light brownish or purplish brown above, lower part of head light brown; opercle with 3 indistinct dark wavy radiating lines, posterior margin of opercle blackish in some specimens, interopercle and subopercle blackish in others; body dark reddish brown posteriorly to first dorsal soft rays and posterior base of anal fin, caudal peduncle and caudal fin yellowish white; spiny dorsal fin dark brown or black, soft dorsal dark at bases of first 2 or 3 rays, rest of rays pale; anal spines and first 6 rays dark reddish brown or black, rest of rays dark basally, pale distally; caudal fin pale yellowish with trace of dusky along upper and lower rays; pelvics dark brown or black; pectoral membranes pale, rays outlined by black color, entire base of pectoral black both on scaly base and extending on base of rays.

Remarks.—This is the first species of this genus in which we have observed the jaw teeth to be different in the two sexes.

We know nothing of the breeding habits of this species but suggest the differences in teeth are correlated with breeding rather than feeding.

We have re-examined the types of *Chromis leucurus* Gilbert (pl. 84,A) from the Hawaiian Islands and *Chromis iomelas* Jordan and Seale from Samoa, and believe these two species to be different from *C. dimidiatus* from the Northern Marshalls and the Philippines, as shown by differences in color and in the number of soft rays in the dorsal and anal fins. *C. iomelas* is dark brown on the anterior half of

TABLE 87.—*Counts for three closely related species of* Chromis

Species	Dorsal soft rays				Anal soft rays					Pectoral rays	
	11	12	13	14	11	12	13	14	15	ii,14	ii,15
dimidiatus											
Marshall Islands		4				4					4
Red Sea (Klunzinger)		1			1						
Philippines	1	6	1			6	2			2	6
leucurus											
Johnston Island			1				1			1	1
Hawaii				1					1	1	
Marshall Islands			22			2	16	3		4	19
iomelas											
Samoa			2				2				2

the body the dark coloring ending at the sixth or seventh dorsal spine and anus, the rest of the body and fins back of this line are pale yellowish white. *C. iomelas* has dorsal fin rays XII,13; anal II,13; pectoral ii,15. *C. leucurus* is dark brown almost to tip of caudal peduncle; the dorsal and anal fins are entirely dark except for the tips of the last 6 rays.

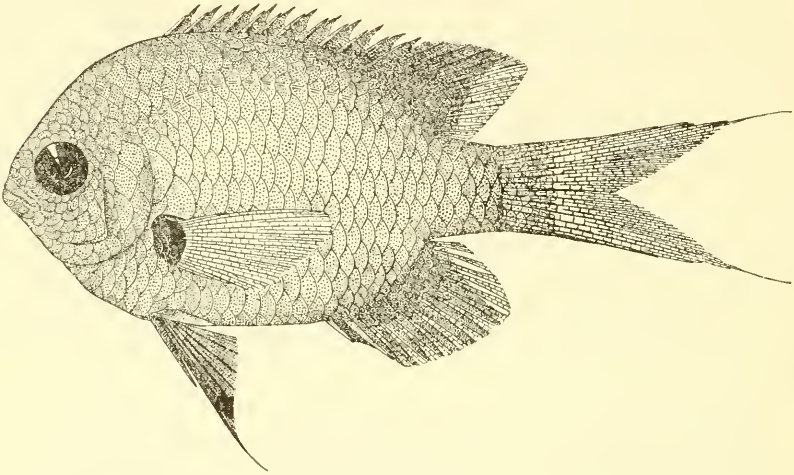

FIGURE 91.—*Chromis leucurus* Gilbert, USNM 141157 from Rongelap Atoll. Drawn by A. M. Awl.

CHROMIS LEUCURUS Gilbert

FIGURE 91; PLATE 84,A

Chromis leucurus GILBERT, Bull. U. S. Fish Comm., vol. 23 (1902), pt. 2, p. 620, pl. 77, fig. 2 (1905) (type locality, Avone Channel off Kauai, Hawaiian Islands, holotype studied).

SPECIMENS STUDIED

Bikini Atoll: 3 stations, 25 specimens, 31 to 61 mm. in standard length.
Rongelap Atoll: 1 station, 5 specimens, 36 to 43 mm.
In addition 2 specimens from Johnston Island were studied.

Description.—Dorsal fin rays XII,13; anal II,12 to 14; pectoral ii,14 or 15; transverse scale rows from upper edge of gill opening to base of caudal rays, 25 to 27, with 3 or 3½ between lateral line and dorsal origin, 9 or 10 between lateral line and origin of anal; upper part of lateral line with 15 or 16 tubular scales; gill rakers 8 or 9+1+21 or 22, totaling 31 or 32 (4 counts).

Depth of body 1.7 to 2.0; length of head 3.2 to 3.4; both in standard length. Snout 3.8 to 4.7; eye 2.4 to 2.9; preorbital width 9.6 to 10.9; length of upper jaw 3.0 to 3.1; postorbital part of head (hind margin of eye to upper edge of gill opening) 2.4 to 2.6; interorbital width 2.5

to 2.8; depth of caudal peduncle 1.8 to 2.0; length of pectoral fin 0.8 to 0.9, of pelvic fin 0.7 to 0.9, length of 3rd dorsal spine 1.7 to 2.2, of upper caudal ray 0.5, of lower caudal ray 0.5 to 0.6; all in length of head (tip of snout to posterior margin of opercular membrane). Depth of caudal peduncle in its length 1.1 to 1.3; angle of snout profile with lengthwise axis of body 44 to 50 degrees.

Body ovate; teeth of jaws biserial, conical, teeth of outer row larger, more widely spaced than those of inner row, which form a narrow irregular band; snout scaled almost to tip; preorbital and suborbital scaled, the latter very narrow, with its margin free and entire; posterior edge of preopercle crenulate; opercular margins entire, covered by scales; opercular membrane narrow; dorsal spines increasing in length to third, the 4th to 6th subequal; soft dorsal and anal pointed; upper and lower caudal rays filamentous, 2 free spines above and below on caudal base; pelvics with outer ray filamentous, pectoral long.

Ecology.—This species was usually taken around coral heads in depths greater than 20 feet. Only 2 specimens out of the total of 31 were collected from shallower water.

Color in alcohol.—Lips light gray, interorbital area, cheeks, and opercles golden brown, a narrow dark brown vertical line along posterior margin of preopercle, fading ventrally between subopercle and interopercle, opercular membrane dark purplish brown, showing through scales on upper portion of opercle; nape, back and sides, and caudal peduncle light purplish brown, scale margins pale, centers with dark brown spot, this character quite distinct on some specimens, appearing as lengthwise bands; breast and belly brownish with yellowish tinge; spiny dorsal membrane dark brown, soft dorsal with first 4 rays dark brown, the rest with bases dark brown and distal portion white; anal with first 7 rays entirely dark brown, the rest with base dark and distal portion pale; caudal fin yellowish basally, pale distally, some specimens with faint dusky color on upper and lower portions and some with entire caudal faintly dusky; pelvics dark brown or black; pectoral pale, its rays outlined by very fine black lines, a large intensely black spot covering entire pectoral base and axil.

Remarks.—William A. Gosline and the authors have discussed the possibility that these specimens along with others may represent a distinct species. To prove that they do, requires more material than is available at present.

Gosline states in a letter to us: "These plain brown-bodied specimens with a black blotch at the pectoral base are here identified as a color form of the black and white *Chromis leucurus*. Comparison of the same two forms from Hawaiian material provides the following information: (1) the black and white and the brown specimens differ little in morphological features or in counts; (2) ripe individuals of both sexes occur in both color forms; and (3) though the two color forms overlap in size ranges, the plain brown form is represented only by specimens 47 to 70 mm., in standard length, whereas black and white specimens range from 17 to 57 mm. In life both forms may be seen over the same coral head."

CHROMIS TERNATENSIS (Bleeker)

Plate 83,C

Heliases ternatensis Bleeker, Nat. Tijdschr. Nederl.-Indië, vol. 10, p. 377, 1856 (type locality, Ternate).

SPECIMENS STUDIED

Bikini Atoll: 1 station, 1 specimen, 60.5 mm. in standard length.
Rongelap Atoll: 1 station, 1 specimen, 41.5 mm.

Description.—Dorsal fin rays XII,11; anal rays II,11; pectorals ii,15 or 16; transverse scale rows from upper edge of gill opening to base of caudal rays, 26, with 2 or 2½ between lateral line and origin of dorsal, 9 between lateral line and origin of anal; upper part of lateral line with 16 tubular scales; gill rakers 7+1+21.

Depth of body 1.9 to 2.0; length of head 3.1 to 3.2; both in standard length. Snout 3.4 to 3.6; eye 2.6 to 2.9; preorbital width 7.0 to 7.7; length of upper jaw 3.0 to 3.2; postorbital part of head (hind margin of eye to upper edge of gill opening) 2.8 to 3.0; interorbital width 2.9 to 3.1; depth of caudal peduncle 2.1 to 2.2; length of pectoral fin 0.9 to 1.0, of pelvics 0.9 to 1.1, of 3rd dorsal spine 2.2 to 2.3, of upper caudal rays 0.6 to 0.7, of lower caudal rays 0.6 to 0.8; all in length of head (tip of snout to posterior margin of opercular flap). Depth of caudal peduncle in its length 1.4 to 1.5; angle of snout profile with lengthwise axis of body 48 degrees.

Body deep, compressed; teeth of jaws in 2 rows, outer row enlarged, conical widely spaced near symphysis, closer laterally, inner row smaller, close set, forming band at symphysis; snout scaled to tip; preorbital and suborbital fully scaled, the former wide, the latter adnate, its margin not distinct, preopercular margin entire, posterior margin not straight but slightly sigmoid; upper branch of lateral line ending beneath 3rd dorsal soft ray, bases of soft dorsal and anal scaled; pectoral fin as long as or longer than head; 2nd anal spine shorter than first anal ray; soft dorsal and anal fins pointed; caudal lobes filamentous.

Color in alcohol.—Top of head and back dark brownish; cheeks, throat, and breast yellowish brown, sides light grayish brown or yellowish brown; scales of back and sides with broad dark brown margin, centers of scales paler; spiny dorsal membranes blackish; soft dorsal dusky basally, pale distally; anal slightly dusky grayish; upper and lower caudal lobes intensely black or brownish, middle caudal rays pale, line of demarcation distinct; pelvics pale or slightly dusky; pectoral pale except upper edge of upper ray with thin black line, no dark spot at base of pectorals.

Genus ABUDEFDUF Forskål

Abudefduf Forskål, Descriptiones animalium . . . , p. 59, 1775 (type species, *Chaetodon sordidus* Forskål, assumed through common name).

We have examined examples of all the species of this genus available in the U. S. National Museum and find that they fall readily into three groups as defined in the key.

Bleeker has recognized *Glyphidodon*, *Amblyglyphidodon*, and *Stegastes* as subgenera of *Abudefduf* but has removed the species here grouped under *Chrysiptera* into a separate genus, *Glyphidodontops* based on the two rows of teeth in the jaws, the absence of scales on the interorbital and prenasal area and the elongate form of the body. We do not consider the *Chrysiptera* group sufficiently distinct to require a separate genus.

KEY TO THE SPECIES OF ABUDEFDUF FROM THE NORTHERN MARSHALL AND MARIANAS ISLANDS

1*a*. Dorsal spines XIII.
  2*a*. Teeth of jaws in a single row (see 2*b* for description of inner row) tips compressed, incisiform, truncate or biscuspid, at least at front of jaws; body deep, compressed; snout, preorbital and suborbital naked or scaled. Subgenus ABUDEFDUF Forskål.
    3*a*. Body and head uniform light brownish yellow when alive, with some blue scales on head; spiny dorsal dusky; dorsal rays usually XIII,12; anal II,14; pectoral I,i,14; scales 26 or 27; gill rakers 7+1+19. **A. aureus** (Cuvier and Valenciennes)
    3*b*. Sides of body with 4 to 6 dark vertical bars.
      4*a*. Dorsal rays XIII,15 or 16; anal rays II,14 or 15; snout, preorbital and suborbital naked; jaw teeth tricuspid in young, bicuspid in half-grown, truncate in adults; body with 5 or 6 transverse dark bars, obscure in adults, a large black spot on dorsal surface of caudal peduncle in specimens of all sizes, a small black spot on dorsal edge of pectoral base; pectoral rays ii,17; upper part of lateral line with 22 tubular scales; gill rakers 11+1+15=27. **A. sordidus** (Forskål)
      4*b*. Dorsal rays XIII,11 to 13; anal II,11 to 13.
        5*a*. Preorbital naked; suborbital partly scaled, often nearly naked in adults; snout or top of head scaled forward to interorbital area or to nostrils.
          6*a*. Top of head scaled forward to nostrils; 5 transverse black bands on body; young with pattern similar to that of adults; snout 4.0 to 5.6 in head; dorsal rays XIII,11 to 13; anal II,11 or 12; pectoral ii,17, lateral line with 20 to 21 tubular scales; gill rakers 7 or 8+1+17=25 to 26______**A. saxatilis** (Linnaeus)

6*b*. Top of head scaled forward to least interorbital width; 6 transverse black bands on body; young with black saddle on dorsal surface of caudal peduncle and black spot on anterior dorsal spines, disappearing with age; snout 3.1 to 3.6 in head; dorsal rays XIII,12 or 13; anal II,12 or 13; pectorals ii,15 to 17; lateral line with 20 to 22 tubular scales; gill rakers 8 to 10+1+14=23 to 25.
A. septemfasciatus (Cuvier and Valenciennes)

5*b*. Preorbitals and suborbitals scaled; snout scaled in front of nostrils.

7*a*. Caudal lobes with lengthwise brown band, middle rays pale; body with 4 or 5 broad transverse brown bands from base of dorsal narrowing ventrally; transverse scale rows (upper edge of gill opening to base of middle caudal rays) 29; upper part of lateral line with 21 tubular scales; dorsal rays XIII,12 or 13; anal rays II,12; pectorals ii,16; gill rakers 7+1+18=26.
A. sexfasciatus (Lacepède)

7*b*. Caudal lobes without lengthwise band, only outer edge of outer rays dusky brown; back sooty brown to lateral line, 3 vertical brown or black bars extending ventrally from brown back, another above pectoral base and one on caudal peduncle; transverse scale rows (from upper edge of gill opening to base of middle caudal rays) 24 to 26; upper part of lateral line with 16 tubular scales, followed by 2 or 3 with pores; dorsal rays XIII,12 (rarely 13); anal II,13 (rarely 12); pectorals ii,14 or 15; gill rakers 7+1+19 to 21=27 to 29.
A. curacao (Bloch)

2*b*. Teeth of jaws in two rows, long, slender, curved, and cylindrical; tips compressed to rounded; teeth of inner row smaller fitting between teeth of outer row; body elongate, robust; never with dark transverse bars; snout, preorbital and suborbital naked. Subgenus CHRYSIPTERA Swainson.

8*a*. Opercle with a pale spot.

9*a*. A black spot at dorsal edge of base of caudal fin prominent at all ages; a narrow blue stripe from snout passes along dorsal edge of eye, widening behind eye and continuing to base of soft dorsal, where it surrounds a large oblong black spot; upper sides brownish, lower sides pale yellowish, belly white; pelvics, anal, and caudal fin pale hyaline; no dusky color on distal portion of caudal fin; dorsal rays, XIII,12 (rarely 13); anal II,12 (sometimes 13); pectoral rays ii,17 (rarely 16); gill rakers 8+1+12 to 14=20 to 23.
A. leucopomus (Lesson)

9*b*. Entire basal third of caudal black; no broad blue stripe from eye to dorsal; body brown, usually with a narrow white transverse bar from 5th to 7th dorsal spines to anus and a second white ring around anterior part of caudal peduncle, area behind pectoral pale; these two bars may be absent but pale pectoral area always evident; pelvics and anal dark brown or black; tips of middle caudal rays dusky; dorsal rays XIII,11 or 12 (usually 12); anal II,12; pectorals ii,16 or 17; gill rakers 6 or 7+1+12 to 13=19 to 21.
A. amabilis (De Vis)

8*b*. Opercle plain brownish.

10*a*. Body plain pale grayish tan, bluish or whitish lower sides with 2 faint inverted V-shaped pale areas; anus black, sharply contrasting with surrounding area; anal fin pale basally with a dusky marginal band; pelvics pale; young with narrow bluish line from snout across top of eye along base of dorsal, breaking up into blue dots, disappearing with age; dorsal rays XIII,12; anal rays II,12; pectoral ii,15 to 17; gill rakers 7 to 9+1+14=22 to 24.
A. glaucus (Cuvier and Valenciennes)

10*b*. Body brownish to blackish, with or without white wedge-shaped transverse bar under 5th to 7th dorsal spines; lower sides and belly brownish; anus dark but not contrasting with surrounding area; anal fin dusky brown or black; pelvics dark grayish brown to black; back with large black ocellus (in most specimens except large adults) just below base of last 4 dorsal spines and a second smaller black spot at base of posterior dorsal rays; specimens 20 to 50 mm. with narrow pale blue lines from snout across top of eye along dorsal base to ocellus, these sometimes absent; dorsal rays XIII,13; anal II,13; pectorals ii,15 or 16; gill raker 8 or 9+1+15 or 16=24 to 26___________**A. biocellatus** (Quoy and Gaimard)

1*b*. Dorsal spines XII; teeth of jaws in single row; body deep, compressed; preorbitals naked or partly scaled; suborbitals scaled. Subgenus NEGOSTEGASTES Whitley.

11*a*. Anal rays II,15 to 17; lips thick, plicate, finely fimbriate; background color of young pale to dark purplish brown, with diagonal dark lines along scale bases; often a large blackish vertical band on side just in front of caudal peduncle, between soft dorsal and anal fins; fins pale in young, sometimes dusky or black in adults; dorsal rays XII,18 (rarely 19); pectoral ii,17; gill rakers 2 or 3+1+11=14 or 15.
A. johnstonianus (Fowler and Ball)

11*b*. Anal rays II,11 to 14.

12*a*. Color of body pale.

13*a*. Color pale, margins of scales with narrow dark marginal bar appearing as fine diagonal lines; a black crescent-shaped band 4 or 5 scale rows wide, originating on anterior soft dorsal rays and extending to tips of anterior anal rays; dorsal rays XII,17 or 18; anal II,14 (rarely 13); pectorals ii,15 to 17 (usually 17); gill rakers 2+1+12 or 13=15 or 16____________**A. dicki** (Liènard)

13*b*. Color plain pale to light grayish or brownish; no spots, stripes, or dark markings except faint short curved lines on bases of scales above lateral line; fins generally all pale and transparent, some specimens with spiny dorsal membranes faintly dusky; black spot on eye between pupil and dorsal edge; dorsal rays II,15 (rarely 14); anal II,11 (rarely 12); pectoral ii,17 to 19 (usually 18); gill rakers 1 or 2+1+8 or 9=10 to 12.
A. imparipennis (Vaillant and Sauvage)

12*b*. Color of body light brown to dark brown.

14*a*. Body dark reddish brown to purplish black; scales of head, back and upper sides with scattered small blue spots (often obscure in alcohol); posterior part of caudal peduncle usually pale yellowish;

caudal fin pale; dorsal, anal, and pelvics dusky or black; a black spot on pectoral base; dorsal rays XII,16 or 17; anal II,13 or 14; pectoral ii,18; gill rakers 9 or 10+1+11 to 14=21 to 23.
A. lacrymatus (Quoy and Gaimard)

14*b*. Body light brownish to uniform dark brown, or with white transverse bars or stripes; scales without pale blue spots.

15*a*. Body light to dark brown; scales of sides with dark marginal line forming fine diagonal lines; small specimens usually with white transverse bar under base of 4th to 6th dorsal spines, a large black ocellate spot on base of last dorsal spines and a small black spot at base of last dorsal soft rays on edge of caudal peduncle; large black spot on upper pectoral base in specimens of all sizes; dorsal rays XII,14 to 16 (usually 15); anal II,11 to 13 (usually 12); pectoral ii,18 or 19; gill rakers 3 or 4+1+11 to 13=15 to 17 ____________________ **A. leucozona** (Bleeker)

15*b*. Body dark brown to almost black with 3 or 4 white transverse lines, the first from nape across opercle, the second from 6th dorsal spine, the third from origin of soft dorsal to base of middle of anal, and the fourth on anterior part of caudal peduncle (first and last of these sometimes indistinct); caudal peduncle with a broad black ring; soft dorsal usually with a black spot near tips of 4th to 8th soft rays; caudal fin yellowish or whitish; a dark crescent-shaped spot on base of pectorals; dorsal rays XII,16 or 17; anal II,13 or 14 (usually 14); pectoral ii,18 or 19; gill rakers 3+1+10=14.
A. phoenixensis Schultz

ABUDEFDUF AUREUS (Cuvier and Valenciennes)

PLATE 84,D

Glyphisodon aureus CUVIER and VALENCIENNES, Histoire naturelle des poissons, vol. 5, p. 472, 1830 (type locality, Java).

SPECIMENS STUDIED

Kwajalein Atoll, Kwadak Island, lagoon, depth 10 feet, Sept. 6, 1951, John Randall, 1 specimen, 91 mm.

Description.—Dorsal rays XIII,12; anal II,14; pectoral I,i,14; scales 26, with 1½ between lateral line and scaly sheath of dorsal fin and 10 between lateral line and anal origin; gill rakers 7+1+19.

Depth of body 1.7; head 3.3; both in standard length. Snout 3.6; eye 2.7; preorbital width 10; length of upper jaw 3.3; postorbital part of head 3.0; interorbital width 2.5; depth of caudal peduncle 1.9 to 2.0; length of pectoral fin 0.8, of pelvic fin 0.6, of fifth dorsal spine 1.3; all in length of head. Angle of snout profile with lengthwise axis of body 50 to 60 degrees, snout profile convex.

Teeth of jaws conical at sides but incisiform, with truncate tips at front of jaws; preorbital and suborbital naked; top of head scaled to in front of nostrils.

Color in alcohol.—Light brownish; spiny dorsal with blackish membranes distally.

Color when alive.—Bright golden yellow; dorsal fin dusky distally.

ABUDEFDUF SORDIDUS (Forskål)

PLATE 86,D

Chaetodon sordidus FORSKÅL, Descriptiones animalium . . . , pp. xxiii, 62, 1775 (type locality, Djedda, Red Sea).

SPECIMENS STUDIED

Bikini Atoll: 13 stations, 22 specimens, 19 to 146 mm. in standard length.
Eniwetok Atoll: 3 stations, 6 specimens, 84 to 149 mm.
Rongelap Atoll: 2 stations, 8 specimens, 20 to 130 mm.
Rongerik Atoll: 1 station, 4 specimens, 20 to 34 mm.
Guam: 4 lots, 5 specimens, 18 to 75 mm.
Saipan: 2 lots, 3 specimens, 17 to 28.5 mm.

Description.—Dorsal fin rays XIII,15 or 16 (usually 15); anal rays II,14 or 15; pectoral rays ii,17 (rarely i,18); scale rows from upper edge of gill opening to base of caudal rays 28 or 29 (usually 28), with 3½ between scaly dorsal sheath and lateral line, 14 between lateral line and origin of anal; upper part of lateral line with 22 perforated scales; gill rakers 11+1+15 (2 counts).

Depth of body 1.6 to 1.9; head 2.7 to 3.0; both in standard length. Snout 3.0 to 3.8, eye 2.9 to 4.15; preorbital width 6.2 to 9.7; length of upper jaw 3.6 to 3.7; postorbital part of head (hind margin of eye to upper edge of gill opening) 2.9 to 3.0; interorbital width 2.8 to 3.6; depth of caudal peduncle 1.8 to 2.0; length of pectoral fin 1.0 to 1.2, of pelvic fin 0.9 to 1.1, of fifth dorsal spine 1.8 to 2.2, of upper caudal ray 0.8 to 1.0; of lower caudal ray 0.9 to 1.0; all in length of head (tip of snout to hind margin of opercular flap). Depth of caudal peduncle in its length 0.8 to 0.9; angle of snout profile with lengthwise axis of body 50 to 60 degrees; snout profile convex.

Teeth of jaws long, cylindrical at base, flattened, truncate, tips entire in specimens over 100 mm., slightly notched in specimens 50 to 60 mm. and trifid in young; preorbital and suborbital entire, naked; preopercle entire, its posterior and ventral lines not scaled; opercle with distinct broad, flat, triangular spine, head scaled on interorbital to front margins of eyes; chin naked; interorbital flat in young, strongly convex in largest specimens; width of preorbital increasing with length of body; soft dorsal, anal, and caudal lobes rounded, pectoral angular, pelvics pointed.

Color in alcohol.—Lips pale, naked portions of snout greyish, back and sides with 10 alternating bands of light reddish brown and dark reddish brown or uniformly dark reddish brown; young specimens up to about 80 mm. usually with distinctly contrasting bands, though these absent in some; specimens of all sizes with small black spot at upper edge of pectoral insertion and broad intense black saddle, about as wide as diameter of eye, on upper part of caudal peduncle just behind soft dorsal fin; vertical fins all dark or dusky in largest specimens, distal half of dorsal pale in middle-sized specimens and soft rays of dorsal, anal, and caudal, pale in specimens under 50 mm.; specimens 18 to 35 mm. with a large round black spot in anterior portion of spiny dorsal reaching from third to 7th spines; pectoral fins pale in specimens under 100 mm., dusky on basal portions in larger ones; pelvics entirely dark or with broad median portion dark in largest specimens, inner rays pale in specimens under 50 mm., with only outer ray black.

Color when alive.—Lips pale whitish, preorbital and suborbital whitish in some specimens, grayish in others; opercular membrane pale; iris yellow, body dark grayish brown with alternating light and dark bands, indistinct in some specimens, with general body color very dark or bands contrasting white and dark grayish brown; black spot on upper pectoral base; broad black saddle on top of caudal peduncle just behind soft dorsal; spiny dorsal fin with scaly sheath dark grayish, spines and membranes light grayish or light tan, soft dorsal dark on basal ¾, with broad yellowish margin on posterior rays; anal blackish; caudal with blackish base, a broad yellowish submarginal band, and with tips of rays black, or caudal completely black; pectorals dusky basally, pale distally, pelvics blackish.

ABUDEFDUF SAXATILIS (Linnaeus)

PLATE 85,B

Chaetodon saxatilis LINNAEUS, Systema naturae, ed. 10, p. 276, 1758 (type locality, India).

SPECIMENS STUDIED

Guam Island, Tumon Bay, Jan. 8, 1946, Gressitt and Ingram, 48 specimens, 41 to 61 mm.; Guam Island, Tumon Bay, Nov. 29, 1945, Gressitt, 2 specimens, 53 and 54 mm.; Guam Island, Nov. 25, 1945, D. G. Frey, 1 specimen, 69 mm.

Description.—Dorsal fin rays XIII,12 (rarely 11 or 13); anal II,12 (rarely 11); pectoral ii,17; transverse scale rows 27 or 28, with 3½ between end of lateral line and scaly dorsal sheath, 11 between lateral line and anal origin; upper part of lateral line with 20 or 21 tubular scales; gill rakers 7 or 8+1+17, totaling 25 or 26 (3 counts).

Depth of body 1.7 to 1.9; head 2.8 to 3.1; both in standard length (tip of snout to upper edge of gill opening). Snout 4.1 to 4.6; eye 2.5 to 3.1; preorbital width 9.7 to 10.9; length of upper jaw 3.3 to 3.4; postorbital part of head (hind margin of eye to upper edge of gill opening 2.7 to 3.1; interorbital width 3.0 to 3.2; depth of caudal peduncle 1.8 to 2.1; length of pectoral fin 0.9 to 1.0; of pelvics 0.9 to 1.5, of 4th dorsal spine 1.7 to 2.0, of upper caudal ray 0.8 to 0.9, of lower caudal ray 0.9; all in length of head (tip of snout to hind margin of opercular membrane). Depth of caudal peduncle in its length 1.1; angle of snout profile with lengthwise axis of body 42 to 49 degrees.

Teeth of jaws flattened, truncate, bicuspid or entire; gill rakers long (about as long as diameter of pupil), slender; preorbital not notched, naked; suborbitals narrow, scaly; preopercle entire, scales not covering its posterior margin; opercular spine small, flat, triangular, head scaled anteriorly to nostrils, interorbital space slightly convex; third and 4th dorsal spines longest, about equal in length to 12th dorsal spine; soft dorsal and anal fins pointed; caudal lobes angular; first pelvic ray filamentous.

Color in alcohol.—Lips dusky brownish or grayish; top of head, dark grayish or brownish; back and sides with 5 broad dark grayish or blackish bars alternating with slightly broader pale whitish or light dusky grayish areas, dark bars narrowing and fading ventrally; spiny dorsal membranes dusky grayish; soft dorsal with large black basal area, anterior rays dusky, posterior rays with distal half pale; anal with anterior rays dusky, posterior rays pale; caudal with basal portion and outer rays dusky, median rays pale; pelvics dusky; pectorals pale with distinct small dark brown or blackish spot on base of upper rays.

ABUDEFDUF SEPTEMFASCIATUS (Cuvier and Valenciennes)

PLATE 86,B

Glyphisodon septemfasciatus CUVIER and VALENCIENNES, Histoire naturelle des poissons, vol. 5, p. 463, 1830 (type locality, Isle de France).

SPECIMENS STUDIED

Bikini Atoll: 7 stations, 29 specimens, 15 to 133 mm. in standard length.
Eniwetok Atoll: 2 stations, 2 specimens, 110 to 143 mm.
Rongelap Atoll: 2 stations, 7 specimens, 16 to 130 mm.
Guam: 7 lots, 19 specimens, 19 to 141 mm.
Saipan: 3 lots, 5 specimens, 13 to 24 mm.
Rota Island: 2 lots, 6 specimens, 22 to 72 mm.

Description.—Dorsal rays XIII,13 (rarely 12); anal II,12 (rarely 13); pectoral rays ii,16 (rarely 15 or 17); scale rows from upper edge of gill opening to base of caudal rays 27 or 28 (usually 27), with 3½ between end of lateral line and scaly dorsal sheath, 11 or 12 between lateral line and origin of anal; upper part of lateral line with 20 to 22 perforated scales; gill rakers 8 to 10+1+14, totaling 23 to 25 (2 counts).

Depth of body 1.8 to 2.1; head 2.5 to 3.1; both in standard length. Snout 3.1 to 3.6; eye 2.5 to 5.9; preorbital width 6.2 to 11.0; length of upper jaw 3.5 to 4.0; postorbital part of head (hind margin of eye to upper edge of gill opening) 2.9 to 3.5; interorbital width 3.0 to 3.4; depth of caudal peduncle 1.7 to 2.1; length of pectoral fin 1.0 to 1.1, of pelvic fin 0.9, of third dorsal spine 1.7 to 3.0, of upper caudal ray 0.8 to 0.9, of lower caudal rays 0.8 to 0.9; all in length of head (tip of snout to hind margin of opercular membrane). Depth of caudal peduncle in its length 0.8 to 1.0; angle of snout profile with lengthwise axis of body 53 to 60 degrees, snout profile convex, steeper in large specimens.

Teeth of jaws cylindrical on basal ⅔, tips flattened, truncate or rounded, entire in adults, 1 or 2 notches in young; preorbital and suborbital entire, naked; preopercle entire, margins not scaled, 3 rows of scales on cheeks; scales on head only to narrowest part of interorbital, opercle with broad, flat, triangular spine, interorbital convex; preorbital width increasing with size of specimens; soft dorsal and anal fins angular, spiny dorsal spines increasing in length to 3rd, 4th, or 5th (which are subequal), then decreasing to 12th, 13th about as long as third; caudal lobes angular.

Color in alcohol.—Lips pale or dusky on sides only, membrane on maxillary black; head dark brownish, sometimes preorbital and suborbital grayish and naked portion of preopercle whitish; opercular membrane blackish, dusky brown, or pale; body with 7 light grayish or yellowish transverse vertical bars alternating with 6 dark brownish or blackish bars of about equal width; spiny dorsal fin membranes grayish with narrow black margin, soft dorsal usually dark basally, paler distally, anal entirely dark, or same as dorsal; caudal dusky, usually tips of rays blackish and sometimes upper and lower margins dusky, pelvics dark grayish; pectorals pale, a small black spot on pectoral base at its upper insertion. Young specimens (under 50 mm.) same as adults, with similar number of transverse bars but with a large black spot on anterior dorsal spines and a black saddle across dorsal part of caudal peduncle, just behind dorsal fin.

Remarks.—Young (under 50 mm.) of this species and of *A. sordidus* are similar in color pattern; they can be distinguished readily by the number of dorsal and anal fin rays, *A. sordidus* having 15 dorsal and 14 or 15 anal rays.

ABUDEFDUF SEXFASCIATUS (Lacepède)

PLATE 85,C

Labrus sexfasciatus LACEPÈDE (on Commerson), Histoire naturelle des poissons, vol. 3, pp. 430, 477, pl. 19, fig. 2, 1802 (type locality, the "Great Ocean").

SPECIMENS STUDIED

Saipan Island, coral reefs, June 1945, F. B. Shroyer and T. S. White, 4 specimens, 10 to 35 mm.; Guam, 1945, D. G. Frey, 2 specimens, 60 and 63 mm.

Description.—Dorsal fin rays XIII,12 or 13; anal rays II,12; pectorals ii,16; transverse scale rows from upper edge of gill opening to base of caudal rays 29, with 3½ between end of lateral line and scaly dorsal sheath, 11 or 12 between lateral line and anal origin; upper part of lateral line with 21 tubular scales; gill rakers on first gill arch 7+1+18 totaling 26 (2 counts).

Depth of body 1.8 to 2.0, length of head 2.9 to 3.0, both in standard length (tip of snout to base of caudal rays). Snout 4.0 to 4.5; eye 2.8 to 2.9; preorbital width 9.4 to 15.0; length of upper jaw 3.4 to 3.5; postorbital part of head (hind margin of eye to upper edge of gill opening) 3.0 to 3.2; interorbital width 2.9 to 3.3; depth of caudal peduncle 1.9 to 2.2; length of pectoral fin 0.9 to 1.1, of pelvic fin 0.9 to 1.0, of fifth dorsal spine 1.7 to 2.1, of upper caudal ray 0.8 to 0.9, of lower caudal ray 0.8 to 0.95; all in length of head (tip of snout to hind margin of opercular membrane); depth of caudal peduncle in its length 1.0 to 1.2; angle of snout profile with lengthwise axis of body 40 to 46 degrees, upper profile nearly straight.

Teeth of jaws cylindrical, flattened, bent, bicuspid or truncate; preorbital straight without notch; preorbital and suborbital scaly; opercular spine very short, inconspicuous; head scaled to tip of snout, interorbital slightly convex; 4th to 8th dorsal spines subequal, dorsal and anal soft rays pointed, lobes of caudal angular; first pelvic ray filamentous.

Color in alcohol.—Lips blackish; upper half of head blackish or dark brown; body with 5 dark brown or black vertical bars alternating with slightly wider light bars, both sets extending onto scaly dorsal sheath, the dark bars narrowing and fading ventrally; lower sides of breast and belly with distinct narrow lengthwise lines extending along intersections of scales, centers of scales pale; spiny dorsal membrane dusky; soft dorsal with large dark spot on basal portion, dusky distally, anal similarly colored; caudal with outer ray dusky, then two broad lengthwise black bands, middle caudal rays pale; pectorals pale, a small black spot on base of upper rays; pelvics dusky on basal half, rest of fin pale.

ABUDEFDUF CURACAO (Bloch)

PLATE 86,A

Chaetodon curacao BLOCH, Naturgeschichte der ausländischen Fische, pt. 3, p. (79) 106, pl. 212, fig. 1, 1787 (type locality, Southern America, Curacao Island but this is an error as pointed out by Günther, Catalogue of the fishes in the British Museum, vol. 4, p. 43, 1862).

Abudefduf curacao KENDALL and GOLDSBOROUGH, Mem. Mus. Comp. Zool., vol. 26, No. 7, p. 297, 1911.

SPECIMENS STUDIED

Bikini Atoll, Arji Island, 100 yards off shore, lagoon coral area at depths from 0 to 40 feet, poison and spear, August 7, S-46-308, Brock and Herald, 2 specimens, 71.5 and 75.5 mm.

Rongelap Atoll: Kabelle Island, north end, lagoon reef, June 20, S–46–231, Schultz and Herald, 1 specimen, 59 mm.

Jaluit Atoll: USNM 65718, January, February, 1900, *Albatross*, 5 specimens, 71 to 94 mm.

Likiep Atoll: Univ. Washington, August 20–22, 1949, 22 specimens, 46 to 63 mm.

Description.—Dorsal fin rays XIII,12 (rarely 13); anal II,13 (rarely 12); pectorals ii,14 or 15 (usually 15); scale rows from upper edge of gill opening to base of caudal rays 24 to 26, with 3 between lateral line and dorsal origin, 1½ between end of lateral line and scaly dorsal sheath, 10 between origin of anal and lateral line; upper part of lateral line with 16 tubular scales and usually 2 or 3 scales with pores following; gill rakers 7+1+19 to 21, totaling 27 to 29 (2 counts).

Depth of body 1.6 to 1.8; head 3.15 to 3.3; both in standard length. Snout 3.5 to 3.8; eye 2.4 to 2.8; preorbital width (measured at notch) 10.0 to 11.0; length of upper jaw 3.2 to 3.3; postorbital part of head (hind margin of eye to upper edge of gill opening) 2.9 to 3.3; interorbital width 2.6 to 2.9; depth of caudal peduncle 2.0 to 2.1, length of pectoral fin 0.8 to 1.0, of pelvic fin 0.7 to 0.8, of 6th dorsal spine 1.3 to 1.5, of upper caudal rays 0.7 to 0.8, of lower caudal rays 0.8; all in length of head (tip of snout to hind margin of opercular flap). Depth of caudal peduncle in its length 1.0 to 1.2; angle of snout profile with lengthwise axis of body 58 degrees.

Teeth of jaws short, cylindrical, only slightly compressed at tips, truncate; preorbital notched; suborbitals notched, both preorbital and suborbital scaly, though latter with naked margin, preopercle with scales covering its posterior but not its ventral margin; opercular spine small, inconspicuous, head completely scaled to tip of snout except area close around nostril, some of head scales with basal accessory scales, interorbital slightly convex; 5th, 6th, and 7th dorsal spines longest, subequal, dorsal and anal soft rays pointed, lobes of caudal pointed or filamentous, first pelvic ray filamentous.

Color in alcohol.—Lips pale or dusky; snout, interorbital, and upper part of head and back dark reddish brown or blackish, lower half of head and body light tan or yellowish; sides with 3 vertical broad dark bands reaching almost to belly, narrowing slightly ventrally, alternating with 3 pale areas; caudal peduncle dusky; spiny dorsal fin membranes yellowish basally, dusky distally, soft dorsal anterior rays dusky, rest of fin pale; anal with anterior rays dusky, rest of fin pale; outer caudal rays dusky, median rays yellowish basally, pale distally; pectorals with upper edge of upper rays dusky, rest of fin pale; outer edge of pelvic spine dusky, rest of fin pale.

Color when alive.—Lips blackish; iris white; top of head and back sooty gray, lower half of head and breast silvery white; belly white; sides with 2 distinct broad vertical bars; ground color bluish green just below lateral line, yellowish about middle; posterior part of body from insertion of soft dorsal and anal rays blackish, vertical bars and dark posterior part made up of vertical oval shaped spots on base of each scale, anterior dorsal and anal soft rays black; upper and lower caudal margins black, middle portion of caudal pale; pelvics pale.

ABUDEFDUF LEUCOPOMUS (Lesson)

PLATE 89,C

Glyphisodon leucopomus LESSON, Voyage . . . la *Coquille* . . . , Zoologie, p. 189. 1830 (type locality, Oualan, Caroline Islands).

SPECIMENS STUDIED

Bikini Atoll: 6 stations, 23 specimens, 16 to 47 mm. in standard length.
Eniwetok Atoll: 2 stations, 4 specimens, 23 to 31 mm.
Rongelap Atoll: 5 stations, 9 specimens, 20 to 40 mm.
Kwajalein Atoll: 1 station, 2 specimens, 42 to 45 mm.
Guam: 10 lots, 85 specimens, 13 to 46 mm.

Description.—Dorsal rays XIII,12 (rarely XIII,13 or XIV,12); anal II,12 (sometimes 13); pectoral rays ii,17 (rarely 16); transverse scale rows from upper edge of gill opening to base of caudal rays 25 to 27 (usually 26), with 2½ between lateral line and origin of dorsal, 8 or 9 between lateral line and origin of anal; upper part of lateral line with 17 to 19 (usually 18) tubular scales; gill rakers 8+1+12 to 14, totaling 21 to 23 (2 counts).

Depth of body 2.2 to 2.3; head 3.1 to 3.4; both in standard length. Snout 3.8 to 4.0; eye 2.6 to 3.2; preorbital width 9.7 to 12.0; length of upper jaw 3.2 to 3.4; postorbital part of head (hind margin of eye to upper edge of gill opening) 2.5 to 2.8; interorbital width 3.8 to 4.2; depth of caudal peduncle 1.9 to 2.1; length of pectoral fin 1.2 to 1.3, of pelvic fin 0.9 to 1.0, of 13th dorsal spine 1.7 to 1.9, of upper caudal rays 1.0, of lower caudal rays 1.0 to 1.1; all in length of head (tip of snout to hind margin of opercular membrane). Depth of caudal peduncle in its length 1.2 to 1.3; angle of snout profile with lengthwise axis of body 58 to 63 degrees, snout profile convex.

Teeth of jaws in a double row those of inner row with their tips fitting into spaces between teeth of outer row, teeth with flattened, rounded tips, scales of interorbital region extending forward on snout almost to nostrils; preorbital and suborbital naked; both margins of preopercle naked; opercle with two flat triangular spines, the lower much larger than upper; dorsal spines subequal after 4th, last only slightly longer than 5th; soft dorsal and anal outlines angular, caudal lobes rounded, pectoral rounded; pelvics with outer row filamentous.

Color in alcohol.—Specimens of all sizes with a broad blue band (almost as wide as eye) extending from upper margin of eye along upper sides to base of anterior half of soft dorsal; lips dark brownish, 2 narrow blue lines on preorbital to lips, these lines sometimes evident on eye also; narrow blue line extending forward on dorsal surface of snout almost to tip, where it meets its fellow; suborbital and dorsal row of preopercular scales with faint blue lines; head dark brown or blackish except for opercle, which has a broad white vertical band; opercular membrane with black spot between spines; body dark brown on back and upper sides, contrasting with pale yellowish white on lower sides, breast, and belly; a dark ocellus, as large as eye, on back just below base of 11th to 13th soft dorsal rays; dorsal surface of caudal peduncle dark blue, silvery, or blackish expanding into a large, intense black spot on the dorsal base of the caudal fin; scales of upper part of sides with 1 or 2 small oblong or round blue spots (these often indistinct in preserved specimens); spiny dorsal membrane dusky basally, distal half pale, a narrow black line on its margin, free flaps black or bicolored; soft dorsal dusky basally on anterior portion only, rest of fin pale; caudal base dusky, outer edges of outer rays with thin brown or blackish line; anal entirely pale or with anterior margin dusky, anus black; pelvics pale except outer edge of spine and first ray dusky brown; pectoral pale with small dark brown or black axillary spot and usually a narrow dark line on dorsal half of its base.

Remarks.—This species is evidently very closely related to *Abudefduf amabilis* De Vis but may be readily separated from it by the color pattern. No intergrading individuals were noted among the several hundred examined.

ABUDEFDUF AMABILIS (De Vis)

Plate 89,D

Glyphidodon amabilis De Vis, Proc. Linnean Soc. New South Wales, vol. 8, p. 452, 1884 (type locality, South Sea Islands).

SPECIMENS STUDIED

Bikini Atoll: 14 stations, 79 specimens, 13 to 55 mm. in standard length.
Eniwetok Atoll: 5 stations, 46 specimens, 32 to 61 mm.
Rongelap Atoll: 3 stations, 14 specimens, 19 to 49 mm.
Kwajalein Atoll: 11 specimens, 23 to 50 mm.
Guam, 8 lots, 92 specimens, 14 to 54 mm.
Rota Island, 10 specimens, 31 to 50 mm.

Description.—Dorsal rays XIII,11 or 12 (usually 12); anal rays II,12; pectorals ii,16 or 17; transverse scale rows from upper edge of gill opening to base of caudal rays 26 or 27, with 2½ scales between lateral line and origin of dorsal, 9 between lateral line and origin of anal; upper part of lateral line with 17 to 19 tubular scales; gill rakers 6 or 7+1+12 or 13 totaling 19 to 21 (4 counts).

Depth of body 2.2 to 2.4; head 3.2 to 3.4; both in standard length. Snout 3.8 to 4.1; eye 3.2 to 3.3; preorbital width 9.1 to 11.3; length of upper jaw 3.3 to 3.4, postorbital part of head (hind margin of eye to upper edge of gill opening) 2.4 to 2.6; interorbital width 3.6 to 4.5; depth of caudal peduncle 1.9 to 2.2; length of pectoral fin 1.2 to 1.3, of pelvic fin 0.9 to 1.0, of 13th dorsal spine 1.8 to 2.0, of upper caudal rays 0.9 to 1.0, of lower caudal rays 1.0 to 1.1; all in length of head (tip of snout to hind margin of opercular membrane). Depth of caudal peduncle in its length 1.1 to 1.3; angle of snout profile with lengthwise axis of body 63 to 66 degrees, snout profile slightly concave in large examples but upper profile strongly convex.

Teeth of jaws crowded, long, slender, curved, basally cylindrical, tips flattened and rounded, in two rows, teeth of inner row slightly smaller and fitting between teeth of outer row near tips; scales of interorbital region not extending as far forward as nostrils; snout and preorbital naked; suborbital naked, both margins of preopercle naked; opercular spines 2, the ventral one largest, both flat, triangular; dorsal spines subequal after 3rd, soft dorsal and anal outlines angular, caudal lobes rounded, pectoral rounded.

Color in alcohol.—Light reddish brown to dark grayish brown or black; opercle pale, membrane black between spines, dusky below spines; body with 3 pale transverse diagonal bars, the first from upper posterior edge of opercle behind pectoral axil to near pelvic insertion, the second from below 5th to 7th dorsal spines to anus, the third across caudal peduncle just behind last soft dorsal rays, the second and third bars may be indistinct or absent and the body uniformly black, except area behind pectoral usually pale; very dark brown or black bar across pectoral base; spiny dorsal membrane brownish with black submarginal line and tips of membranes pale, soft dorsal basally dark brown or black and distal half of soft rays pale; anal entirely dark brown or black; posterior part of caudal peduncle and base of caudal fin intense black (in young the black is confined to upper part, the remainder being merely dusky) rest of caudal fin pale, except that some specimens have outer edges of upper and lower rays dusky and tips of median rays dusky, pelvics dark brown or black, pectorals pale.

Remarks.—Only very few specimens from the Marshalls bore the middle transverse bar, several had the anterior part of the caudal peduncle pale; all possessed the pale opercle and light area behind the pectoral; in our numerous examples from the Marianas the ratio was reversed, nearly all specimens having the 3 transverse bars and only a few being uniformly dark colored; when all specimens were carefully compared, intermediate color patterns were observed.

ABUDEFDUF GLAUCUS (Cuvier and Valenciennes)

Plate 87,A

Glyphisodon glaucus Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 5, p. 475, 1830 (type locality, Guam).

Abudefduf antjerius (not Kuhl and Van Hasselt) Kendall and Goldsborough Mem. Mus. Comp. Zool., vol. 26, p. 297, 1911.

SPECIMENS STUDIED

Bikini Atoll: 13 stations, 189 specimens, 13 to 84 mm. in standard length.
Eniwetok Atoll: 4 stations, 54 specimens, 44 to 87 mm.
Rongelap Atoll: 1 station, 133 specimens, 20 to 59 mm.
Rongerik Atoll: 3 stations, 12 specimens, 17 to 60 mm.
Kwajalein Atoll: 1 station, 1 specimen, 56 mm.
Arno Atoll: 1 lot, 1 specimen, 31 mm.
Rota Island: 2 lots, 59 specimens, 12 to 72 mm.
Guam: 18 lots, 376 specimens, 13 to 58 mm.
Saipan: 1 lot, 1 specimen, 21 mm.

Description.—Dorsal fin rays XIII,12; anal rays II,12; pectorals ii,15 to 17 (usually 16); transverse scale rows from upper edge of gill opening to base of caudal rays, 26 to 28 (usually 27), with 2½ between lateral line and origin of dorsal, 8 or 9 between lateral line and origin of anal; upper part of lateral line with 17 or 18 (usually 18) tubular scales; gill rakers 7 or 8+1+14, totaling 22 to 24 (4 counts).

Depth of body 2.0 to 2.4; head 3.0 to 3.4; both in standard length (tip of snout to base of caudal rays). Snout 3.4 to 4.5; eye 2.0 to 3.4; preorbital width 7.8 to 12.6; length of upper jaw 3.3 to 3.6; postorbital part of head (hind margin of eye to upper edge of gill opening) 2.6 to 3.2; interorbital width 3.3 to 5.0; depth of caudal peduncle 1.8 to 2.3; length of pectoral fin 1.2 to 1.4, of pelvic fin 1.0 to 1.2, of 13th dorsal spine 1.8 to 2.0, of upper caudal rays 0.9 to 1.0, of lower caudal rays 1.0 to 1.1; all in length of head (tip of snout to hind margin of opercular membrane). Depth of caudal peduncle in its length 1.1 to 1.5; angle of snout profile with lengthwise axis of body 56 to 58 degrees, snout profile convex.

Teeth of jaws, crowded, long, slender, slightly curved, rounded basally, flattened, rounded tips, in two rows, inner row smaller, tips of teeth fitting between teeth of outer row; scales of interorbital region extending to anterior margin of eye, snout and area around nostrils naked; orbital bones and both margins of preopercle naked; opercular spines 2, broad, flat, small, scarcely evident in large examples; dorsal spines subequal after 4th; soft dorsal and anal outlines angular, caudal slightly forked, lobes rounded, pectoral rounded.

Color in alcohol.—Lips pale dusky brown to grayish, head, back and upper sides uniform light reddish brown, grayish brown or pale whitish, on some specimens dark grayish usually a faint light, narrow vertical bar across posterior edge of opercle and 2 faint but usually evident pale extensions from light belly dorsally into brown of sides, the first about even with anus the second vertical from anterior ⅓ of anal fin; anus black; spiny dorsal fin membranes dusky, soft dorsal usually pale though sometimes light dusky brown; anal usually pale basally with a dusky marginal band; caudal pale basally, the middle rays usually dusky, outer rays pale or dusky; pelvics always pale; pectoral pale yellowish, no basal axillary spot.

Young with a narrow bluish line running from middle of snout along upper margin of eye and along base of dorsal where, as fish grows larger, the stripe breaks up into bluish dots; upper part of caudal peduncle pale silvery or bluish, sometimes bluish or black lines from anterior margin of eye across upper lip.

Remarks.—The coloration of young specimens (and some larger ones up to 50 mm.) is very similar to that of *A. antjerius* except that *antjerius* has a black ocellus in the spiny dorsal and black spot in the soft dorsal; these are never present in *glaucus.*

ABUDEFDUF BIOCELLATUS (Quoy and Gaimard)

PLATES 84,C; 85,D

Glyphisodon biocellatus QUOY and GAIMARD, Voyage autour du monde . . . sur . . . l'*Uranie* et la *Physicienne,* Zoologie, p. 389, 1824 (type locality, Guam).

Glyphisodon zonatus CUVIER and VALENCIENNES, Histoire naturelle des poissons, vol. 5, p. 483, 1830 (Coast of New Guinea; Vanikolo).

Glyphisodon antjerius KUHL and VAN HASSELT *in* Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 5, p. 481, 1830 (Antjer, Java).

Abudefduf zonatus KENDALL and GOLDSBOROUGH, Mem. Mus. Comp. Zool., vol. 26, p. 297, 1911 (Jaluit).

SPECIMENS STUDIED

Bikini Atoll: 14 stations, 453 specimens, 15 to 83 mm. in standard length.
Eniwetok Atoll: 5 stations, 142 specimens, 20 to 83 mm.
Rongelap Atoll: 4 stations, 37 specimens, 20 to 60 mm.
Rongerik Atoll: 4 stations, 23 specimens, 24 to 67 mm.
Jaluit Atoll: 1 lot, 1 specimen, 69 mm.
Likiep Atoll: 1 lot, Univ. Washington, 1949, 1 specimen, 55 mm.
Guam: 9 lots, 20 specimens, 17 to 57 mm.

Description.—Dorsal fin rays XIII,13; anal II,13; pectoral rays ii,16 (rarely 15); transverse scale rows from upper edge of gill opening to base of caudal rays 25 to 27 (usually 26), with 2½ between lateral line and origin of dorsal, 8 or 9 between lateral line and origin of anal; upper part of lateral line with 16 to 19 tubular scales; gill rakers 8 or 9+1+15 or 16, totaling 24 to 26 (4 counts).

Depth of body 2.1 to 2.2; length of head 2.7 to 3.4; both in standard length. Snout 3.4 to 4.6; eye 2.5 to 3.7; preorbital width 7.6 to 12.2; length of upper jaw 3.3 to 3.5; postorbital part of head (hind margin of eye to upper edge of gill opening) 2.5 to 2.8; interorbital width 3.2 to 4.1; depth of caudal peduncle 1.8 to 2.4; length of pectoral fin 1.2, of pelvic fin 0.9 to 1.1, of 13th dorsal spine 1.9 to 2.7, of upper caudal rays 0.9 to 1.0, of lower caudal rays 1.0 to 1.1; all in length of head (tip of snout to posterior margin of opercular membrane). Depth of caudal peduncle in its length 1.0 to 1.1; angle of snout profile with lengthwise axis of body 52 to 63 degrees, snout profile slightly concave in large specimens, upper profile convex.

Teeth of jaws in two series, those of inner row smaller, crowded between those of outer row, which are larger, teeth slender, cylindrical basally, tips flattened, rounded; snout, preorbital and suborbital, and ring around eye naked; both margins of preopercle naked; opercular spines 2, broad, flat, triangular, lower spine larger than upper; dorsal spines subequal after 4th, soft dorsal and anal outlines angular, caudal lobes rounded, pectoral rounded, pelvics pointed in large specimens, outer ray filamentous in small.

Color in alcohol.—In specimens over 50 mm., general body color light reddish brown to dark reddish, grayish or blackish brown; lips dusky grayish to pale grayish, naked suborbital and preorbital and naked margins of preopercle often paler than scaly portion of preopercle and opercle, which are dark brown; a white or yellowish V-shaped vertical bar on upper sides from below 5th to 7th dorsal spines to a point even with lower pectoral base, often indistinct or absent; caudal peduncle pale yellowish except on largest and darkest specimens; breast and belly lighter than back and sides, sometimes yellowish; some specimens with an indefinite white or pale spot below white bar; most specimens with a large black spot below the base of the last 3 dorsal spines and a spot behind last dorsal soft rays extending onto rays, these spots more or less disappear with age, the anterior spot disappearing first (however, some specimens of about 40 mm. lacked both spots, whereas both were evident in specimens of 76 mm.); spiny dorsal membrane dusky brown its margin and free flaps black; soft dorsal dusky basally, distal ⅔ pale; anal usually dark brown or black basally and on distal portion of anterior rays, last 3 or 4 rays paler; caudal usually pale yellowish, with distal ⅓ dusky but sometimes entire caudal is dusky; pelvics black or dusky brown, inner ray usually slightly paler; pectoral pale, with a small dark brown or black axillary spot.

In specimens 20 to 50 mm. head with 2 narrow pale blue lines extending from eye along dorsal base to large black ocellus on base of 10th to 13th dorsal spines, and anteriorly converging near tip of snout; usually a narrow blue line across eye below pupil, thence across preorbital to upper lip, and a narrower line below eye to rictus; upper part of head and back dark brown, sometimes with tiny blue dots on each scale, sides below lateral line becoming paler ventrally, lower sides light dusky brown with faint lengthwise lines, belly yellowish, caudal peduncle pale yellowish with faint brownish dots on bases of some scales; dorsal dusky with a large black ocellus on last 3 rays and a black spot on last soft rays extending along dorsal surface of caudal peduncle in some specimens; distal portion of last dorsal rays pale but with faint fine brownish barring; anal dusky basally anteriorly, a narrow black line along ventral margin, sometimes a faint barred line across middle of pale posterior rays; caudal pale hyaline, outer edges of upper and lower rays with narrow black line; pelvics pale or dusky, if pale the outer edge of spine and first ray have narrow black line; pectoral pale a small brown spot on base of upper rays.

Color when alive.—A 55-mm. specimen has the back and sides purplish brown or blackish; breast and belly light brown; prominent black spots about as large as eye below last dorsal spines and at posterior base of soft dorsal; chin and opercle yellowish; preopercle brownish; iris yellow; wedge-shaped bar light purplish brown flecked with white; spiny dorsal orange, with distinct narrow black marginal line; soft dorsal bright yellow; caudal yellowish orange, anal blackish; pelvics black; pectoral bright yellow.

Remarks.—We have examined over 700 specimens, ranging in size from 15.5 mm. to 83 mm., many of these were intermediate between typical *biocellatus* and typical *zonatus*. The size at which the juvenile colors are no longer evident varies from about 25 to 50 mm.; specimens as small as 33 mm. had partially assumed the darker colors of adults and nearly lost the blue lines on the head while these were retained in some as large as 47 mm. This species shows considerable variation in color pattern, and between all extremes and varieties our large series contain some intermediate forms.

ABUDEFDUF JOHNSTONIANUS (Fowler and Ball)

PLATES 86,C; 88,A

Plectroglyphidodon johnstonianus FOWLER and BALL, Proc. Acad. Nat. Sci Philadephia, vol. 76, p. 271, 1924 (type locality, Johnston Island).

SPECIMENS STUDIED

Bikini Atoll: Univ. Washington, 1946, 1 lot, 2 specimens, 45 to 68 mm. in standard length.
Rongelap Atoll: 1 station, 3 specimens, 41.5 to 49 mm.
Eniwetok Atoll: 1 station, 5 specimens, all 21 mm.
Johnston Island: August 1947, 9 specimens, 56 to 77 mm.

Description.—Dorsal fin rays XII,18 (rarely 19); anal II,15 to 17 (usually 16); pectoral rays ii,17; transverse scale rows from upper edge of gill opening to base of caudal rays 27 to 30 (usually 29), with 4½ between lateral line and origin of dorsal fin, 11 or 12 between lateral line and origin of anal; upper part of lateral line with 21 or 22 tubular scales; gill rakers 2 or 3+1+11, totaling 14 or 15 (4 counts.).

Depth of body 1.7 to 1.8; length of head 2.9 to 3.7; both in standard length. Snout 3.2 to 3.7; eye 3.1 to 3.8; preorbital width 5.7 to 6.9; length of upper jaw 3.7 to 3.9; postorbital part of head (hind margin of eye to upper edge of gill opening) 2.6 to 2.8; interorbital width 2.9 to 3.2; depth of caudal peduncle 1.9 to 2.1; length of pectoral fin 1.1 to 1.2, of pelvic fin 1.1 to 1.2, of 13th dorsal spine 1.6 to 1.9, of upper caudal rays 1.0 to 1.1, of lower caudal rays 1.0 to 1.1; all in length of head (tip of snout to posterior margin of opercular membrane); depth of caudal peduncle in its length 0.7 to 1.0; angle of snout profile with lengthwise axis of body 53 degrees.

Teeth of jaw uniserial, long, slender, curved, blunt-pointed or rounded, scales extending forward on snout to beyond nostrils; preorbitals only partially scaled, suborbitals scaled; preopercular margins scaled, scales on opercle extending beyond opercular margin to posterior edge of opercular flap, which is narrow, opercular spine not evident; lips thick, plicate, finely fimbriate; dorsal spines gradually increasing in length to last; soft dorsal and anal rounded in young, angular or pointed in largest specimens; caudal lobes angular; pelvics pointed; pectoral angular.

Color in alcohol.—Head and body purplish brown, lower parts somewhat paler, upper fins all dusky in largest specimen (77 mm.); medium sized individuals (50 to 65 mm.) with narrow dark vertical lines along scale bases, appearing as a cross-hatching upon a light yellow background; top of head and back dark brown or blackish; fins all blackish, except pectoral which is dusky, usually an indistinct dark brown blotch across posterior part of body just anterior to caudal peduncle or posterior part of body from insertion of anterior dorsal and anal soft rays; caudal posterior to end of scaly portion blackish; smaller specimens (40 to 50 mm.) may have posterior part of body pale yellowish, or with a very distinct dark blotch smaller than described above; in these specimens the dorsal fin is dusky blackish and the rest of the fins completely pale or with dark edging. Backs of post-larvae (21 mm.) brownish with large black spot under the soft dorsal base, underparts silvery, spiny dorsal black-edged, a trace of dusky coloring on distal portion of upper pectoral rays, remaining fins pale.

Ecology.—The post larvae, 21 mm. in standard length, are pelagic.

Remarks.—Fowler and Ball have made this species the type of a separate genus, *Plectroglyphidodon*, "distinguished from *Abudefduf* by the plaited lips." It is true that the lips are thick, ridged, and fringed, but in other respects, e. g., scalation of orbital and opercular bones, number of dorsal fin spines, spiny dorsal outline, large number of dorsal and anal fin rays, low number of gill rakers (especially on upper branch), shape of body, and form of teeth of jaws, this species resembles the other members of the subgenus *Negostegastes*. "*Plectroglyphidodon*" is intermediate in lip form between *Negostegastes* and *Cheiloprion* Weber. *Cheiloprion labiatus* Day is thus related to the *Negostegastes* group, but in that species the lips are very much thickened, curled back, and fringed, in this species the jaw teeth are finer than those in species of *Negostegastes*.

Although both *Cheiloprion labiatus* and "*Plectroglyphidodon*" *johnstonianus* may be distinguished on the basis of their thickened lips, nearly all the rest of their external characters are similar to *Abudefduf* (*Negostegastes*) *leucozona* Bleeker, the type species of this subgenus. If we recognize the genera *Cheiloprion* and *Plectroglyphidodon* we lose sight of the close relationship to *Negostegastes* and if we do not recognize them we perhaps do not sufficiently emphasize their specialization. However, because of the relatively large number of species involved it seems best to group these species in as large natural groups as possible rather than separate each species that shows some slight aberrance or specialization.

ABUDEFDUF DICKI (Liènard)

PLATE 86,E

Glyphisodon dickii LIÈNARD, Soc. Hist. Nat. Maurice, $10^{me.}$ Rapp. Ann., p. 35, 1839 (type locality, Mauritius).

SPECIMENS STUDIED

Bikini Atoll: 6 stations, 10 specimens, 33 to 71 mm. in standard length.
Rongelap Atoll: 3 stations, 5 specimens, 41 to 48 mm.
Rongerik Atoll: 2 stations, 2 specimens, 58 to 66 mm.
Kwajalein Atoll: 1 station 6 specimens, 31 to 56 mm.
Guam: 1 lot, 1 specimen, 30 mm.

Description.—Dorsal fin rays XII,17 or 18; anal II,14 (rarely 13); pectoral rays ii,15 to 17 (usually 17); transverse scale rows from upper edge of gill opening to base of caudal rays 27 to 29 (usually 29), with 3½ or 4 between end of lateral line and scaly dorsal sheath, 12 between lateral line and anal origin; upper part of lateral line with 20 to 22 tubular scales; gill rakers 2+1+12 or 13, totaling 15 or 16 (2 counts).

Depth of body 1.7 to 1.9; head 2.7 to 3.3; both in standard length. Snout 3.3 to 3.5; eye 2.3 to 3.7, preorbital width 6.4 to 11.3; length of upper jaw 3.6 to 3.8; postorbital part of head (hind margin of eye to upper edge of gill opening) 2.7 to 2.9; interorbital width 2.7 to 3.3; depth of caudal peduncle 1.8 to 2.4; length of pectoral fin 1.0 to 1.3, of pelvic fin 0.9 to 1.2, of last dorsal spine 1.4 to 2.1, of upper caudal rays 0.8 to 1.2, of lower caudal rays 0.9 to 1.3; all in length of head (tip of snout to hind margin of opercular flap); depth of caudal peduncle in its length 1.0 to 1.1; angle of snout profile with lengthwise axis of body 47 to 59 degrees, upper profile convex.

Teeth of jaws long, slender, cylindrical, curved, close set, numerous, produced, their tips only slightly flattened, entire, rounded, pale brown; lips, thick, curled back but not fimbriate or rugose; preorbital not notched, naked, suborbital scaled; scales on top of head anterior to nostrils, many with basal accessory scales; interorbital convex; preopercular margin entire, opercular spine not evident, hidden by scales; gill rakers on lower branch of first arch short, wedge-shaped, the 2 of upper branch close to angle, rest of upper branch of arch smooth, enlarged and fleshy; dorsal spines gradually increasing in length to last, soft dorsal rounded in small specimens 30 to 40 mm., and in largest (72 mm.) anterior rays of both dorsal and anal produced and filamentous; caudal lobes angular, pelvics with outer ray filamentous though not much elongated; pectoral short and rounded.

Color in alcohol.—Lips dark grayish brown, top of head reddish brown or dark brown; margins of scales of back and sides with narrow, vertical, dark brown bar and pale yellowish bases, so that body has appearance of many fine diagonal lines following the transverse scale rows and slanting upward and slightly posteriorly; lower sides and belly light reddish brown; black crescent-shaped band 4 or 5 scale rows wide on posterior part of body, originating on anterior dorsal rays and extending to tips of anterior anal rays; caudal peduncle and caudal fin bright yellow or pale whitish, outer edges of upper and lower caudal rays with thin black line basally; scaly sheath of spiny dorsal reddish brown, membrane and spines dusky grayish or blackish, anterior dorsal rays dark gray or blackish, posterior rays pale; anal almost entirely black but last 4 or 5 rows lighter, sometimes pale; pelvics with outer rays dusky brown, inner two pale; pectoral fin pale, its base bright or pale yellowish.

ABUDEFDUF IMPARIPENNIS (Vaillant and Sauvage)

PLATE 87,E

Glyphisodon imparipennis VAILLANT and SAUVAGE, Rev. Mag. Zool., ser. 3, vol. 3, p. 279, 1875 (type locality, Honolulu).

SPECIMENS STUDIED

Bikini Atoll, 11 stations, 91 specimens, 29 to 45 mm. in standard length.
Eniwetok Atoll: 1 station, 2 specimens, 44 mm.
Rongelap Atoll: 1 station, 4 specimens, 38 to 44 mm.
Rongerik Atoll, 2 stations, 5 specimens, 38 to 45 mm.

Description.—Dorsal fin rays usually XII,15 (rarely 14 or 16); anal rays II,11 (rarely 12); pectorals ii, 17 to 19 (usually 18); transverse scale rows from upper edge of gill opening to base of caudal rays 28 (rarely 27), with 2½ between end of lateral line and scaly dorsal sheath, 10 between lateral line and origin of anal; upper part of lateral line with 20 tubular scales; gill rakers 1 or 2+1+8 or 9, totaling 10 to 12 (4 counts).

Depth of body 2.1 to 2.3; head 3.0 to 3.1; both in standard length. Snout 3.6 to 3.8; eye 2.8 to 3.2; preorbital width 6.9 to 10.4; length of upper jaw 3.6 to 4.4; postorbital part of head (hind margin of eye to upper edge of gill opening) 2.6 to 2.9; interorbital width 3.6 to 3.9; depth of caudal peduncle 2.2 to 2.4; length of pectoral fin 1.2 to 1.3; of pelvic fin 1.1 to 1.3; of second dorsal spine 1.7 to 2.0, of upper caudal rays 1.0 to 1.1, of lower caudal rays 1.2 to 2.0; all in length of head (tip of snout to hind margin of opercular membrane). Depth of caudal peduncle in its length 1.4; angle of snout profile with lengthwise axis of body 50 degrees, snout profile convex.

Teeth of jaws slender, curved, round-tipped, close set, in a single row and somewhat protruding, preorbital with shallow notch, naked, suborbital with 2 or 3 large very thin widely spaced scales; scales on top of head anterior to front margin of eye but not reaching nostrils; interorbital convex; preopercular margin naked; opercular spine relatively strong, sharp; gill rakers weak, widely spaced, the 1 or 2 on upper arch close to angle, rest of upper arch smooth, enlarged, fleshy; second or third dorsal spine longest, next 2 or 3 subequal then gradually decreasing in size to last, which is not set closely against soft rays; soft dorsal outline angular, anal rounded, caudal lobes rounded, pelvics with outer ray filamentous though not much elongated, pectoral rounded.

Color in alcohol.—Generally whitish, with dorsal part of head light dusky; lower lip pale, upper lip and tip of snout dusky; top of head dark grayish or grayish brown; eye with intense black spot between pupil and upper margin; sides above lateral line dark grayish brown, the bases of the scales with dark curved line margins pale; dorsal edge of caudal peduncle with a narrow dark line or at least darker than sides below lateral line; body generally uniformly pale yellowish, though some specimens show thin vertical brown lines following scale rows, these formed by darker basal lines on scales; fins generally all pale transparent, though some dark specimens with spiny dorsal membranes faintly dusky. Specimens 30 mm. and shorter may have a small dusky spot at rear base of soft dorsal fin.

Remarks.—Fowler (Proc. Acad. Nat. Sci. Philadelphia, vol. 93, p. 266, fig. 7, 1941) has made this species the type of a separate genus, *Oliglyphisodon*, "distinguished from *Abudefduf* chiefly by its reduced gill rakers." In his description the number of gill rakers is given as 7 on the lower branch. We have found 8 or 9 in four specimens examined. In the various other species of the subgenus *Negostegastes* Whitley, into which *imparipennis* fits (by virtue of its XII dorsal spines, the outline of the dorsal fin, shape of body, and kind of teeth), the number of gill rakers on the lower part of the first gill arch ranges from 10 to 14. We do not believe this slight difference is sufficient to warrant placing *imparipennis* in a separate genus.

ABUDEFDUF LACRYMATUS (Quoy and Gaimard)

PLATE 87,B

Glyphisodon lacrymatus, QUOY and GAIMARD, Voyage autour du monde . . . sur . . . l'*Uranie*, et la *Physicienne*, Zoologie, p. 388, pl. 62, fig. 7, 1825 (type locality, Guam).

SPECIMENS STUDIED

Bikini Atoll: 17 stations, 207 specimens, 15 to 78 mm. in standard length.
Eniwetok Atoll: 1 station, 1 specimen, 62 mm.
Rongelap Atoll: 7 stations, 171 specimens, 17 to 75 mm.
Rongerik Atoll: 3 stations, 45 specimens, 23 to 76 mm.
Likiep Atoll: Univ. Washington, 1 lot, 19 specimens, 48 to 68 mm.

Description.—Dorsal fin rays XII,16 or 17; anal rays II,13 or 14; pectoral rays ii,18, scale rows from upper edge of gill opening to base of middle caudal rays 26, with 3 from lateral line to base of dorsal (not counting those of dorsal fin sheath), 10 from lateral line to origin of anal; upper part of lateral line with 19 to 22 tubular scales; gill rakers 9 or 10+1+11 to 14, totaling 21 to 23.

Depth of body 1.8 to 1.9; head 2.8 to 3.3; both in standard length. Snout 3.3 to 4.3; eye 2.6 to 3.5; least preorbital width 6.8 to 11.2; length of upper jaw 3.4 to 3.9; postorbital part of head 2.5 to 2.7; interorbital width 3.0 to 3.3; depth of caudal peduncle 1.9 to 2.0; length of pectoral fin 0.9 to 1.1; of pelvics 0.8 to 1.0; of longest dorsal spine (12th) 1.5 to 2.3; of upper caudal ray 0.7 to 0.8, of lower caudal ray 0.9 to 1.0; all in length of head (tip of snout to hind margin opercle). Depth of caudal peduncle in its length 1.0 to 1.1; angle of snout profile with lengthwise axis of body 50 to 60 degrees, snout profile convex.

Teeth of jaws in single row long, slender, close set, compressed, truncate, those of middle of jaws with shallow dent; bones of orbital and opercle all entire; preorbital naked, suborbital scaled; spines of dorsal fin gradually increasing in height, with the last being longest; angles of soft dorsal and anal pointed; caudal forked, lower lobe angular, shorter; upper lobe pointed, longer.

Color in alcohol.—Lips, top of snout and interorbital area blackish, body light brown, dark brown, or blackish with numerous small, rounded, usually black-bordered white or bluish spots scattered over posterior part of head, back, and upper sides (these spots sometimes indistinct); scales usually with very dark narrow borders, center of scale lighter on light specimens, giving appearance of transverse dark lines or crosshatching; caudal peduncle usually pale yellowish or light reddish brown in small specimens, but may be same color as rest of body (usually as dark as body in specimens over 70 mm.). Spiny dorsal blackish; soft dorsal blackish anteriorly and on scaly base, naked part of posterior half usually smoky grayish or whitish; anal fin completely blackish, or black basally and marginally with lighter middle part; caudal usually yellowish or pale whitish, in some specimens caudal is dusky and in some black basally, with middle rays and posterior quarter pale grayish (all gradations from white to black present in series studied); pectorals pale with very narrow black lines along rays, base black; pelvics very dark brown to black.

Color when alive.—Iris yellow; very dark brown or purplish head and body; scale margins darker, scale centers lighter; nuchal area and upper part of sides with numerous scattered small blue dots; naked portion of soft dorsal yellow, posterior half of caudal peduncle light brown; caudal fin light yellowish brown basally, pure yellow distally; pelvics and anal fin blackish.

Ecology.—This was the most abundant species of *Abudefduf* on the shallow parts of the reefs. Hundreds of specimens were discarded.

ABUDEFDUF LEUCOZONA (Bleeker)

PLATE 87,C,D

Glyphisodon leucozona BLEEKER, Nat. Tijdschr. Nederl.-Indië, vol. 19, p. 339, 1859 (type locality, Karangbollong, Java).

Abudefduf corneyi JORDAN and DICKERSON, Proc. U. S. Nat. Mus., vol. 34, p. 613, fig. 5, 1908 (type locality, Suva, Fiji).

Abudefduf behnii JORDAN and SEALE (not Bleeker), Bull. U. S. Bur. Fish., vol. 25, p. 285, 1906. (Apia, Samoa.)

SPECIMENS STUDIED

Bikini Atoll: 2 specimens, 52 to 53 mm. in standard length.
Kwajalein Atoll: 1 specimen, 34 mm.
Guam: 9 lots, 78 specimens, 13 to 71 mm.
Rota Island: 2 lots, 5 specimens, 68 to 87 mm.
Saipan: 3 specimens, 17 to 46 mm.

Description.—Dorsal fin rays XII,14 to 16 (usually 15); anal rays II,12 (rarely 11 or 13); pectoral rays ii,18 (sometimes 19); transverse scale rows from upper edge of gill opening to base of caudal rays 27 to 29 (usually 28), with 3½ from lateral line to dorsal origin, 10 or 11 from lateral line to anal origin; upper branch of lateral line with 20 tubular scales; gill rakers 3 or 4+1+11 to 13, totaling 15 to 17 (4 counts).

Depth of body 1.8 to 1.9; length of head 3.0 to 3.2; both in standard length. Snout 3.4 to 3.6; eye 2.8 to 3.6; preorbital width 5.8 to 6.3;

length of upper jaw 3.3 to 3.8; postorbital part of head (hind margin of eye to upper edge of gill opening) 2.6 to 2.8; interorbital width 3.1 to 3.3; depth of caudal peduncle 1.9 to 2.0; length of pectoral fin 1.1 to 1.2, of pelvics 1.0 to 1.1, of longest dorsal spine (3rd, 4th or 5th) 1.8 to 1.9, of upper caudal rays 0.9, of lower caudal rays 1.0 to 1.5; all in length of head (tip of snout to posterior margin of opercular membrane). Depth of caudal peduncle in its length 1.0 to 1.2; angle of snout profile with lengthwise axis of body 59 to 64 degrees, snout profile convex.

Teeth of jaws in single series, long, curved, expanded basally, flattened distally, tips truncate; scales extending onto snout to about even with nostrils, rest of snout and preorbital naked; suborbital scaled; vertical margin of preopercle scaled, lower horizontal margin naked; opercle with one flat triangular spine, opercular membrane narrow, only slightly wider than opercular spine is long; dorsal spines increasing in length to 3d, 4th and 5th subequal, the rest successively very slightly shorter; soft dorsal angular in young, rounded in largest specimens; anal angular; upper caudal lobe angular, lower rounded, pelvics with outer ray filamentous, pectoral angular.

Color in alcohol.—Lips pale, tip of snout and chin sometimes dark brownish, sometimes pale yellowish; black ring around margin of eyeball, most intense dorsally, opercle plain yellowish or with several (6 to 8) white spots slightly smaller than pupil; sometimes smaller white spots on preopercle and sometimes margins of preopercle dark reddish brown; ground color of head and back rich brownish or blackish, scales of sides with thin vertical dark brown marginal line, giving appearance of fine crosshatching, ground color of sides light yellowish; small specimens usually with a white transverse bar under the base of 4th to 6th spines extending toward anus, fading on belly; this bar is usually lost in largest specimens over 60 mm., but may be retained indistinctly by some (sometimes bar is indistinct or absent in small specimens 30 to 40 mm.), a black ocellus as large as eye at base of last dorsal spines present in young, becoming indistinct in specimens over 50 mm. and usually disappearing in those over 60 mm.; a small black spot present on base of last soft dorsal rays; a large distinct black spot on base of upper rays of pectoral fin, growing larger and more distinct with age; dorsal fin dark brown or blackish, except tips of dorsal rays, which are paler; caudal dusky or blackish basally; anal blackish; pelvics dark brown or blackish; pectorals pale.

Remarks.—*Abudefduf behnii* Bleeker has XIII dorsal spines and belongs in a different subgenus. We have examined the type (USNM 61678) of *A. corneyi* Jordan and Dickerson and find it to be identical with our specimens of *A. leucozona* from Guam. This species varies considerably in color pattern from young to adult stages but our fairly large series contains intermediate sizes and shows the transitions of color pattern in all stages.

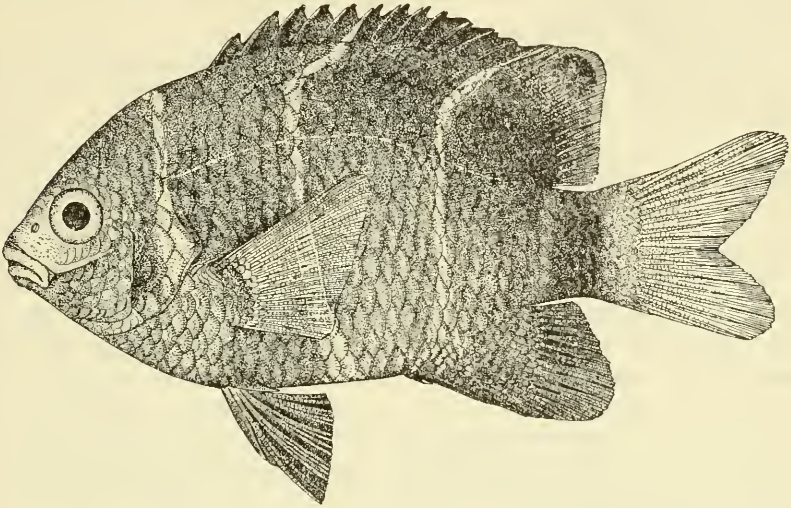

FIGURE 92.—*Abudefduf phoenixensis* Schultz, holotype, USNM 115782 from Enderbury Island. Drawn by A. M. Awl.

ABUDEFDUF PHOENIXENSIS Schultz

FIGURE 92

Abudefduf phoenixensis SCHULTZ, U. S. Nat. Mus. Bull. 180, p. 190, fig. 15, 1943 (type locality, Enderbury Island, Phoenix Islands).

SPECIMENS STUDIED

Bikini Atoll: 6 stations, 35 specimens, 20 to 63 mm. in standard length.
Eniwetok Atoll: 2 stations, 8 specimens, 48 to 57 mm.
Rongerik Atoll: 6 specimens, 48 to 52 mm.

Description.—Dorsal fin rays XII,16 or 17; anal rays II,13 or 14 (usually 14); pectoral rays ii,18 or 19; scale rows (upper edge of gill opening to base of caudal rays) 27 to 29 (usually 28), with 3 between scaly dorsal sheath and lateral line, 10 between lateral line and origin of anal; upper parts of lateral line with 21 or 22 perforated scales; gill rakers 3+1+10 (2 counts).

Depth of body 1.9 to 2.1; head 2.8 to 3.0; both in standard length (tip of snout to base of middle caudal rays). Snout 3.4 to 4.1; eye 2.8 to 3.6; preorbital width 6.9 to 8.6; length of upper jaw 3.6 to 3.9; postorbital part of head (hind margin of eye to upper edge of gill opening) 2.7 to 2.8; interorbital width 3.2 to 3.7; depth of caudal peduncle 2.1 to 2.6; length of pectoral fin 1.0 to 1.1, of pelvic fin 1.0 to 1.3, of 12th dorsal spine 2.2, of upper caudal rays 0.9 to 1.0, of lower caudal rays 1.0 to 1.1; all in length of head (tip of snout to hind margin of opercular flap). Depth of caudal peduncle into length of caudal peduncle 1.25 to 2.0; angle of snout profile with lengthwise axis of body 47 to 50 degrees.

Bones of preorbital and suborbital, preopercle, opercle, subopercle, and interopercle all entire, though some specimens with preopercle crenulate; spines of dorsal fin gradually increasing in length, with 12th the longest; angles of soft dorsal and anal pointed, caudal forked, lobes angular, upper rays longer than lower. Teeth of jaws in single row, long, slender, slightly curved, tips bluntly pointed or rounded; head scaled to a point even with nostrils, chin and preorbital not scaled.

Color in alcohol.—Head and body light grayish brown to dark chocolate brown, snout and breast usually paler than back and sides; body with 3 or 4 narrow transverse vertical white bars, the first from nape across opercle to a point even with pectoral base, sometimes indistinct, in some specimens this band represented on opercle only by white spots, second bar from midway on 6th dorsal spine, curving slightly anteriorly then slightly posteriorly toward anus, but usually fading on belly before reaching anus, the third white bar from the origin of soft dorsal to base of middle of soft anal fin; caudal peduncle with broad black ring bordered anteriorly by prominent white line and posteriorly, usually, with faint white line, the latter often indistinguishable from pale caudal fin; scaly sheath of dorsal brownish, spiny dorsal membranes grayish brown, with narrow dark brown or blackish margin; a black spot (ocellus in young) near outer margin of 4th to 8th dorsal soft rays; anal fin very dark brown or blackish; caudal yellowish or whitish with outer edges of upper and lower rays blackish basally; pelvics dark grayish brown; pectorals pale grayish with black basal bar on crescent-shaped spot; axil of base of pectoral blackish.

Color when alive.—As described for preserved specimens except transverse vertical bars light tan and caudal white.

Genus POMACENTRUS Lacepède

Pomacentrus Lacepède, Histoire naturelle des poissons, vol. 4, p. 505, 1803 (type species, *Chaetodon pavo* Bloch).

KEY TO THE SPECIES OF POMACENTRUS FROM THE NORTHERN MARSHALL ISLANDS AND ADJOINING REGIONS

1*a*. Dorsal spines XII; teeth of jaws uniserial.
  2*a*. Preorbital wide, its least width nearly equal to eye in adults; no black spots on upper part of pectoral base or base of last dorsal rays; dorsal fin rays XII,15; anal II,13 .... **P. lividus** (Bloch and Schneider)
  2*b*. Preorbital narrower, its least width ½ to ⅔ eye in adults; black spot present on pectoral base and on base of last dorsal rays though latter somewhat obscured.

3*a*. Snout scaled anterior to nostrils but not to tip of snout; lower margin of preopercle scaled (at least in adults); dorsal fin rays XII,16 (sometimes 15 or 17); anal rays II,13 (sometimes 14, rarely 12).
P. nigricans (Lacepède)

3*b*. Snout naked anterior to nostrils, scales barely reaching line drawn between nostrils; lower margin of preopercle naked; dorsal fin rays XII,15 (sometimes 14, rarely 16); anal rays II,12 (rarely 11 or 13).
P. albofasciatus[27] Schlegel and Müller

1b. Dorsal spines XIII.

4a. Teeth of jaws uniserial, dorsal rays XIII,16 (rarely 15 or 17), preorbital naked, no enlarged horizontal or curving spines on lower posterior part; suborbital scaled, finely serrate; scales of sides with pale centers and broad dark brown margins, forming diagonal transverse lines; no black spot on opercle or on dorsal; a small black spot on base of upper pectoral rays, and axil black; anal rays II,13 (rarely 14).
P. jenkinsi Jordan and Evermann

4*b*. Teeth of jaws biserial at least in part, sometimes the inner row of teeth found only in center of jaws, or on sides, represented as small teeth between the larger ones.

5*a*. Preorbital with one or two large, posteriorly directed curved spines; opercle with a black spot; orbital ring naked.

6*a*. Dorsal rays XIII,15 or 16; anal II,16 (rarely 14 or 15); small black spot on base of upper pectoral ray; large black spot, sometimes white-bordered, on base of 7th to 12th soft dorsal rays.
P. vaiuli Jordan and Seale

6*b*. Dorsal rays XIII,13 (rarely 14); anal II,13 (rarely 14); no black spot on base of upper pectoral ray; no black spot on base of soft dorsal rays; scales of body with short vertical blue or pale bar and dark base and margin, these forming alternating light and dark lines; a blue or white streak or line from dorsal edge of eye to tip of snout-------------------------------------**P. pavo** (Bloch)

5*b*. Preorbital entire, without a posteriorly directed spine on its lower posterior margin.

7*a*. Opercle without a black spot; greatest depth 1.9 to 2.2.

8*a*. Dorsal rays XIII,11 (rarely 10 or 12); anal II,12; suborbital narrow, scaled; a black spot about size of eye on bases of last 3 dorsal spines and one on first two anal rays; anus black; caudal peduncle yellow; head and body light reddish brown; small indistinct blue dots on head and anterior part of body.
P. traceyi, new species

8*b*. Dorsal rays XIII,14 or 15; anal II,13 or 14; suborbital narrow, naked, except possibly a scale or so on *melanopterus*.

9*a*. Middle dorsal spines 5th to 7th longer than last; no black spot on base of pectoral; body ground color pale yellowish with a black band on nape narrowing ventrally to opercles, a second wider band between 6th dorsal spine and first soft ray, narrowing ventrally and fading about middle of sides; soft portions of vertical fins, pectorals, and pelvics pale; dorsal rays XIII,14 or 15; anal II,14-------**P. bifasciatus** Bleeker

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[27] Not yet found in Northern Marshall Islands.

9*b*. Dorsal spines gradually increasing in length to last; large black spot across entire pectoral base; body ground color dark reddish brown; vertical fins all dark, except posterior half of anal, pelvics dark, pectoral pale; dorsal rays XIII,14; anal II,13 ---------------------- **P. melanopterus** Bleeker

7*b*. Opercle with a small black spot, sometimes obscured by blackish background coloration; orbital ring (preorbital and suborbital) naked, and without spines; greatest depth about 2.5 in standard length.

10*a*. Dorsal rays usually XIII,14; anal II,15; background coloration dark brown dorsally (pale spots on head and on scales indistinct or absent) from rear of base of soft dorsal forward, including head, then abruptly whitish or pale posteroventrally from level of lower edge of pectoral base posteriorly, including caudal peduncle and caudal fin; spiny dorsal dark brown; soft dorsal pale; anal fin pale, except distal edge has a black line ---------------- **P. coelestis** Jordan and Starks

10*b*. Dorsal rays usually XIII,13; anal II,13 or 14, usually II,14; background coloration light brown with vertically elongate white streaks on scales and posteroventrally, body not abruptly pale or white; caudal peduncle dusky; caudal fin pale or whitish ---------------- **P. caeruleus** [28] (Bloch)

POMACENTRUS LIVIDUS (Bloch and Schneider)

PLATE 89,A

Chaetodon lividus BLOCH and SCHNEIDER, Systema ichthyologiae . . . , p. 235, 1801 (type locality, Pacific Ocean).

SPECIMENS STUDIED

Guam: Point Oca, December 25, 1945, Gressitt, 1 specimen, 84.5 mm. in standard length.

Description.—Dorsal fin rays XII,15; anal rays II,13; pectoral ii,16; transverse scale rows from upper edge of gill opening to base of caudal rays 27, with 2½ between lateral line and origin of spiny dorsal, 10 between lateral line and origin of anal; upper part of lateral line with 18 tubular scales; gill rakers 8+1+14.

Depth of body 2.0; length of head 3.2; both in standard length. Snout length 2.8; eye 3.8; preorbital width 3.9; length of upper jaw 3.4; postorbital part of head (hind margin of eye to upper edge of gill opening) 2.95; interorbital width 2.9; least depth of caudal peduncle 1.9; length of pectoral fin 1.1, of pelvics 1.0, of 13th dorsal spine 1.6, of upper caudal rays 1.0, of lower caudal rays 1.1; all in length of head (tip of snout to posterior margin of opercle). Depth of caudal peduncle in its length 1.3; angle of snout profile with lengthwise axis of body 68 degrees.

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[28] Not yet found in Marshall Islands.

Teeth of jaws uniserial, close together, curved, truncate or rounded; scales on top of head not extending on snout anterior to nostrils; preorbital naked, wide (almost equaling width of eye), its lower posterior margin serrate; suborbital scaled, serrate; preopercular margins naked, vertical limb finely serrate; membranes between dorsal spines with simple, entire margin, not incised or lobed, soft dorsal outline rounded; caudal lobes rounded; soft portion of anal angular; outer pelvic ray long and filamentous; pectorals short, rounded.

Color in alcohol.—Back reddish brown; lips dark brown; naked part of snout, preorbital, and top of head blackish; cheeks dark brown, opercle blackish; breast and belly dark reddish; scales of back and sides with very dark brown or blackish submarginal line, scale bases reddish brown; vertical fins black basally, gradually becoming brownish distally, margins grayish brown; pelvics dark grayish brown; pectorals light grayish brown, no black spot on pectoral base, axil of pectoral reddish brown.

Color when alive.—Yellowish orange below, brownish dorsally; fins yellowish; sides below lateral line with about 8 series of lengthwise rows of blue spots, one on each scale; brown spot at rear base of soft dorsal.

POMACENTRUS NIGRICANS (Lacepède)

PLATE 90,C

Holocentrus nigricans LACEPÈDE, Histoire naturelle des poissons, vol. 4, p. 332, 367, 1803 (type locality, none given).

SPECIMENS STUDIED

Bikini Atoll: 7 stations, 20 specimens, 26 to 75 mm. in standard length.
Eniwetok Atoll, 3 stations, 136 specimens, 17 to 91 mm.
Rongelap Atoll: 6 stations, 23 specimens, 21 to 90 mm.
Rongerik Atoll: 3 stations, 26 specimens, 36 to 86 mm.
Likiep Atoll: 1 lot, Univ. Washington, 53 specimens, 39 to 85 mm.
Guam: 4 lots, 93 specimens, 24 to 87 mm.

Description.—Dorsal fin rays XII,15 to 17 (usually 16); anal rays II,12 to 14 (usually 13); pectoral rays ii,17 (rarely 18); scale rows from upper edge of gill opening to base of caudal fin 27 to 29 (usually 28), with 3 between lateral line and origin of spiny dorsal, 11 between lateral line and origin of anal; upper part of lateral line with 18 or 19 tubular scales; gill rakers 10+1+15.

Depth of body 1.7 to 2.1; length of head 2.7 to 3.0; both in standard length. Length of snout 3.1 to 3.7; diameter of eye 2.6 to 3.5; preorbital width 5.8 to 9.7; length of upper jaw 3.2 to 3.7; postorbital part of head (hind margin of eye to upper edge of gill opening) 2.8 to 3.0; interorbital width 3.4 to 4.4; depth of caudal peduncle 2.0 to 2.4; length of pectoral fin 1.1 to 1.3, of pelvic fin 0.9 to 1.0, of last dorsal spine 1.5 to 2.1, of upper caudal rays 0.9 to 1.1; of lower caudal rays 1.0 to 1.3; all in length of head (tip of snout to posterior edge of opercular membrane). Depth of caudal peduncle into length of caudal peduncle 0.9 to 1.1; angle of snout profile with lengthwise axis of body 58 to 64 degrees.

Teeth of jaws in a single series, long, curved, cylindrical basally, tips flattened and somewhat truncate; scales extending on snout anterior to nostrils but not to tip of snout; preorbital naked serrate (only in large specimens) on its lower posterior corner; suborbital scaled, serrate in specimens over 40 mm., entire in smallest specimens; preopercular margin scaled, vertical limb finely serrate; spines of dorsal fin gradually increasing in length to last; soft dorsal and anal outlines angular; caudal lobes rounded, pectoral rounded.

Color in alcohol.—Head and body color varies from light brown to blackish brown; snout and interorbital darker brown than lips and chin; some specimens with a white line on suborbital and round pale spots on cheek and opercle; all with black spot on base of upper pectoral rays, a black or black-edged scale just above anterior lateral line scale; a black spot larger than pupil but smaller than eye on base of last 3 or 4 soft dorsal rays; scales of sides with dark brown basal spot and dark brown margin, intervening area pale, sometimes white; very often 2 or 3 rows of white spots, above anterior part of anal fin, extending onto scaly sheath of anal between second spine and first soft ray; spiny dorsal membranes dark brown with distal edge black; soft dorsal dark brown basally, distal portion of rays grayish brown, caudal dark brown or black basally, distal portion lighter (specimens under 35 mm. with caudal entirely pale); anal usually entirely black, though sometimes posterior rays are pale; pelvics dark brown; pectoral pale with black basal spot, axil of pectoral dark brown to black.

Remarks.—We have included with this species those specimens, with a white line under the eye and white spots on side of head and above anterior part of anal, which were called *P. taeniops* by Cuvier. We have found no meristic or proportional differences in specimens of this coloration and we have many specimens which show these markings very faintly, thus intergrading between typical black *nigricans* and spotted *taeniops*.

POMACENTRUS ALBOFASCIATUS Schlegel and Müller

PLATES 88,B; 90,D

Pomacentrus albofasciatus SCHLEGEL and MÜLLER, Verh. Nat. Gesch. Zool., Leiden, vol. 2, p. 21, 1839–44 (type locality, northeast coast of Celebes).

SPECIMENS STUDIED

Guam: 11 lots, 59 specimens, 16 to 74 mm. in standard length.
Rota Island: 3 lots, 18 specimens, 15 to 63 mm.

Description.—Dorsal fin rays XII,14 to 16 (usually XII,15); anal rays II,12 (rarely II,11 or 13); pectoral rays ii,17 or 18 (usually 18);

scale rows from upper edge of gill opening to base of caudal rays 26 to 28 (usually 27), with 3 or 3½ between lateral line and origin of spiny dorsal, 10 or 11 between lateral line and origin of anal; upper part of lateral line with 19 tubular scales; gill rakers 11+1+14.

Depth of body 1.9 to 2.0; length of head 2.8 to 3.2; both in standard length. Snout 3.3 to 4.2; eye 2.7 to 3.5; preorbital width 5.4 to 9.0; length of upper jaw 3.2 to 3.6; postorbital part of head (hind margin of eye to upper edge of gill opening) 2.6 to 3.1; interorbital width 3.3 to 4.0; depth of caudal peduncle 1.9 to 2.3; length of pectoral fin 1.1 to 1.2, of pelvic fin 0.9 to 1.1, of 12th dorsal spine 1.6 to 2.0, of upper caudal rays 0.9 to 1.0, of lower caudal rays 1.0 to 1.1; all in length of head (tip of snout to posterior margin of opercular membrane). Depth of caudal peduncle into length of caudal peduncle 1.0 to 1.1; angle of snout profile with lengthwise axis of body 59 to 70 degrees.

Teeth of jaws in a single series, long, curved, cylindrical basally, tips flattened and truncate; scales on snout extending anteriorly to nostrils; preorbital naked, serrate on its lower posterior angle; suborbital scaled serrate, serrations becoming more numerous and stronger with age; preopercle strongly serrate on vertical limb, both lower and vertical limbs naked; opercle with a flat triangular spine; spines of dorsal gradually increasing in length to last; soft dorsal and anal outlines angular; caudal lobes angular, caudal moderately forked, pelvics pointed; pectoral rounded.

Color in alcohol.—Head and body color varies from dark brown to light brown; tip of snout dark grayish black, chin yellowish gray, some specimens with small white spots, smaller than pupil, on opercles; light and dark specimens have dark brown submarginal line on each scale of back and sides, base of scale light brown, tan, or even white; a black spot about the size of pupil to size of eye in base of last soft dorsal rays, sometimes with faint pale area before it or surrounding it; some specimens with scaly sheath of spiny dorsal black; spiny dorsal membranes black between first to fourth spines, rest of membranes and anterior half of soft dorsal dark brown; caudal pale gray to black, some specimens with a black horizontal chevron mark across fin about middle of rays; anal black basally, anterior rays dark brown, tips of posterior rays light brown or pale; outer pelvic rays dark brown, inner pale brown, pectoral pale a black spot on base of upper 3 or 4 rays, pectoral axil dark brown or black on upper half.

Remarks.—None of these specimens has a definite white area anterior to black spot on posterior soft dorsal rays, as has been described as characterizing *Pomacentrus eclipticus*, and is still clearly shown in the types of that species. Although some of our specimens, especially pale individuals or small ones, do have a pale area around the spot it is not distinct and is considered to be not sufficiently striking to include any of our specimens from the Marianas in the species *eclipticus*.

POMACENTRUS JENKINSI Jordan and Evermann

Plate 90,B

Pomacentrus jenkinsi Jordan and Evermann, Bull. U. S. Fish. Comm., vol. 22, p. 189, 1902 (1903) (type locality, Honolulu).

Pomacentrus inornatus Schultz (Non De Vis) U. S. Nat. Mus. Bull. 180, p. 184, 1943 (Swains Island; Samoa).

Pomacentrus atrilabiatus Fowler, Proc. Acad. Nat. Sci. Philadelphia, vol. 98, p. 146, figs. 15, 16, 1946 (type locality, Riu Kiu Islands).

SPECIMENS STUDIED

Bikini Atoll: 26 stations, 429 specimens, 17 to 90 mm. in standard length.
Eniwetok Atoll: 5 stations, 27 specimens, 15 to 78 mm.
Rongelap Atoll: 7 stations, 107 specimens, 23 to 77 mm.
Rongerik Atoll: 4 stations, 25 specimens, 30 to 83 mm.
Kwajalein Atoll: 4 specimens, 51 to 65 mm.

Description.—Dorsal fin rays XIII,15 to 17 (usually 16); anal rays II,13 (rarely 14); pectoral ii,16 to 19 (usually 18); transverse scale rows from upper edge of gill opening to base of caudal rays 28 or 29, with 3½ or 4 between lateral line and dorsal origin, 12 or 13 between lateral line and anal origin; upper part of lateral line with 20 (rarely 21) tubular scales; gill rakers 7 to 9+1+12, totaling 20 to 22.

Depth of body 1.8 to 2.0; length of head 3.1 to 3.3; both in standard length. Snout 3.3 to 3.5; eye 2.9 to 3.6; preorbital width 6.7 to 8.9; length of upper jaw 3.5 to 3.8; postorbital part of head (hind margin of eye to upper edge of gill opening) 2.4 to 2.6; interorbital width 2.9 to 3.5; depth of caudal peduncle 1.8 to 2.0; length of pectoral fin 1.1 to 1.2, of pelvic fin 0.9 to 1.0, of 13th dorsal spine 1.6 to 2.1, of upper caudal rays 0.8 to 0.9, of lower caudal rays 0.9 to 1.1; all in length of head (tip of snout to posterior margin of opercular membrane). Depth of caudal peduncle in its length 0.9 to 1.0; angle of snout profile with lengthwise axis of body 55 to 63 degrees.

Teeth of jaws uniserial, truncate, even, close together; scales not extending on snout anterior to nostrils; preorbital naked, suborbital scaled and finely serrate; posterior margin of preopercle naked, ventral margin of preopercle naked and entire, opercle scaled to edge, opercular membrane narrow; dorsal spines gradually increasing in length to last; soft dorsal and anal outlines angular; caudal shallowly forked, upper lobe angular, lower rounded; pectorals angular, pelvics with outer ray long and filamentous.

Color in alcohol.—Dorsal part of head, back and sides dark reddish brown; tip of snout blackish; posterior part of lips blackish, cheeks, opercle, and breast light brown; scales of sides with pale centers, broad blackish margins forming diagonal transverse lines fading on belly and caudal peduncle; caudal peduncle often light reddish brown but usually the same color as body; scaly sheaths of vertical fins dark blackish brown; membranes of spiny dorsal blackish, soft dorsal and anal very dark brown anteriorly and basally, lighter posteriorly and distally; caudal fin dark blackish brown or dark brown on basal ⅔, paler on distal ⅓; intensely black spot on base of upper pectoral rays; pectoral light grayish brown, axil black; pelvics black.

Young with head and body paler than adults but with diagonal transverse lines on sides; posterior half of body light yellowish brown; caudal fin pale yellowish; large black spot covering almost entire scaly basal portion of pectoral.

Color when alive.—Head and body dark purplish brown, almost blackish, tip of snout and chin blackish, lips pale, sides with distinct narrow transverse lines following margins of scales, scaly bases of vertical fins dark purplish black; distal portion of spiny dorsal membranes brown; distal margins of soft dorsal and caudal fins pale, anal fin blackish, except distal tips of posterior soft rays; pelvics black; black spots on pectoral base.

Remarks.—This species has been confused with *Pomacentrus inornatus* De Vis but on the basis of Whitley's redescription of the holotype it is certainly distinct; *P. jenkinsi* has a scaly suborbital and one or more soft rays in the dorsal fin than *P. inornatus*.

POMACENTRUS VAIULI Jordan and Seale

PLATE 89,B

Pomacentrus vaiuli JORDAN and SEALE, Bull. U. S. Bur. Fish., vol. 25 (1905), p. 280, pl. 40, fig. 2, 1906 (type locality, Apia and Pago Pago, Samoa).

SPECIMENS STUDIED

Bikini Atoll: 19 stations, 107 specimens, 24 to 64 mm. in standard length.
Eniwetok Atoll: 2 stations, 7 specimens, 43 to 74 mm.
Rongelap Atoll: 8 stations, 71 specimens, 25 to 63 mm.
Rongerik Atoll: 2 specimens, 29 to 31 mm.
Likiep Atoll: 1 lot, Univ. Washington, 3 specimens, 60 to 62 mm.

Description.—Dorsal rays XIII,15 (sometimes 16); anal II,14 to 16 (usually 16); pectorals ii,15 or 16; transverse scale rows from upper edge of gill opening to base of caudal rays 25 to 28 (usually 27 or 28), with 3 between lateral line and origin of dorsal fin; 9 or 10 between lateral line and origin of anal; upper part of lateral line with 17 or 18 tubular scales; gill rakers 7+1+14 (3 counts).

Depth of body 1.8 to 2.1; length of head 2.9 to 3.3; both in standard length. Snout 3.4 to 4.5; eye 2.4 to 3.3; preorbital width 9.2 to 16.2; length of upper jaw 3.2 to 3.4; postorbital part of head (hind margin of eye to upper edge of gill opening) 2.4 to 2.9; interorbital width 3.5

to 3.9; depth of caudal peduncle 2.0 to 2.2; length of pectoral fin 1.0, of pelvic fin 0.9 to 1.0, of last dorsal spine 1.6 to 1.8, of upper caudal rays 0.9, of lower caudal rays 0.9 to 1.1; all in length of head (tip of snout to posterior margin of opercle). Depth of caudal peduncle in its length 0.9 to 1.0; angle of snout profile with lengthwise axis of body 45 to 48 degrees.

Teeth of jaws in double series at least in front, teeth cylindrical basally, compressed, tips rounded or bluntly pointed, inner row of teeth smaller, finer, sharply pointed; scales extending forward on snout to just in front of nostrils, preorbital and suborbital naked; posterior margin of preopercle naked, opercle scaled to edge; suborbital with strong spines; 1 or 2 enlarged curved spines on posterior edge preorbital just above corner of mouth; preopercle with strong spines; opercle with a single, flat, triangular spine; dorsal spines gradually increasing in length to last; soft dorsal and anal outlines angular; caudal with shallow fork, upper rays longer, lower lobe rounded; pelvics pointed, outer ray filamentous; pectorals angular.

Color in alcohol.—Head and back light reddish brown; breast and belly pale brownish yellow; head with numerous fine blue lines extending from snout and hind margin of eye posteriorly, these breaking up on back into lengthwise rows of larger blue dots, sides of head and cheeks with small blue dots; a round black dot only slightly smaller than pupil at upper edge of opercular opening; each scale on back and sides with (near base) one, two, or three blue dots forming lengthwise lines and a reddish brown margin forming oblique narrow lines; caudal peduncle pale yellowish, blue spots appearing brownish here, smaller and fading posteriorly; soft dorsal with a black spot slightly smaller than eye on base of 7th to 12th rays; caudal fin pale yellowish; anal dark brown except for tips of last 3 or 4 rays; pelvic rays brown, membranes pale; pectorals pale yellowish, a distinct small brown spot at base of upper rays, axil pale.

Young with head and anterior part of body pale yellowish; belly and lower sides dark reddish brown; 2 broad brown stripes from tip of snout to dorsal origin; a broad line from upper edge of eye to under middle of spiny dorsal; lines on sides of head and body brownish; black spot on soft dorsal with pale ring; caudal peduncle and fin dusky.

Color when alive.—Lips yellow; iris yellow, eye with bright blue lines joining blue lines on snout; lengthwise lines on body iridescent blue; base of pectoral reddish orange; posterior ⅔ of body purplish brown; spiny dorsal dark basally; membranes orange distally with black margins; black spot on soft dorsal surrounded by blue ring; caudal fin bright golden yellow.

POMACENTRUS PAVO (Bloch)

Plate 88,D

Chaetodon pavo Bloch, Naturgeschichte der aüslandischen Fische, pt. 3, p. 6, pl. 198, 1787 (type locality, East Indies).

Pomacentrus pavo Kendall and Goldsborough, Mem. Mus. Comp. Zool., vol. 26, p. 295, 1911 (Tari Tari, Gilbert Islands, 2 specimens studied).

SPECIMENS STUDIED

Bikini Atoll: 1 station, 12 specimens, 34 to 61 mm. in standard length.
Rongelap Atoll: 1 station, 3 specimens, 38 to 57 mm.

Description.—Dorsal rays XIII,13 (rarely 14); anal II,13 (rarely 14); pectoral ii,14 to 16 (usually 15); transverse scale rows from upper edge of gill opening to base of caudal rays 27 to 29, with 3 between lateral line and origin of dorsal, 9 or 10 between lateral line and origin of anal; upper part of lateral line with 16 to 18 tubular scales; gill rakers 7+1+14.

Depth of body, 2.3 to 2.5; length of head 3.3 to 3.6; both in standard length. Snout 4.4 to 4.9; eye 2.7 to 3.4; preorbital width 10.6 to 17.0; length of upper jaw 3.2 to 3.4; postorbital part of head (hind margin of eye to upper edge of gill opening) 2.2 to 2.6; interorbital width 3.4 to 4.1; depth of caudal peduncle 1.9 to 2.1; length of pectoral fin 1.1 to 1.2; of pelvic fin 0.9 to 1.0; of 13th dorsal spine 1.8 to 2.0; of upper caudal rays 0.6 to 0.7; of lower caudal rays 0.7 to 0.8; all in length of head (tip of snout to posterior margin of opercular membrane). Depth of caudal peduncle in its length 1.1 to 1.4; angle of snout profile with lengthwise axis of body 45 to 53 degrees, snout convex.

Teeth of jaws biserial, outer row cylindrical basally, flattened and curved distally, with rounded tips, inner row small teeth fitting close against spaces of outer row, flattened, pointed; scales on snout extending forward to nostrils; preorbital and suborbital naked, former with a single horizontal curved spine at its lower posterior margin, latter smooth on lower margin of anterior ⅓, strongly serrate on posterior ⅔; posterior margin of preopercle naked, strongly serrate; opercle with flat triangular spine; dorsal spines gradually increasing in length to last; soft dorsal, anal and caudal lobes pointed; pelvics pointed; pectoral rounded.

Color in alcohol.—Head yellow or brown with numerous narrow blue lines converging at tip of snout, on cheeks, and on subopercle, these broken into rows of round white dots; a black spot about size of pupil on opercular margin near upper edge of gill opening; scales of body with dark brown base and usually brown margin, and with short vertical blue bar across middle joining with bars on scales above and below to form alternating light and dark bars; spiny dorsal membrane dark brown; soft dorsal pale, except anterior 3 or 4 rays brownish to tips; caudal dusky basally, the dusky area sometimes extending along lobes a short distance, outer and middle rays with colorless tips; anal dusky brown basally, usually pale distally; anus black: pelvics and pectorals pale.

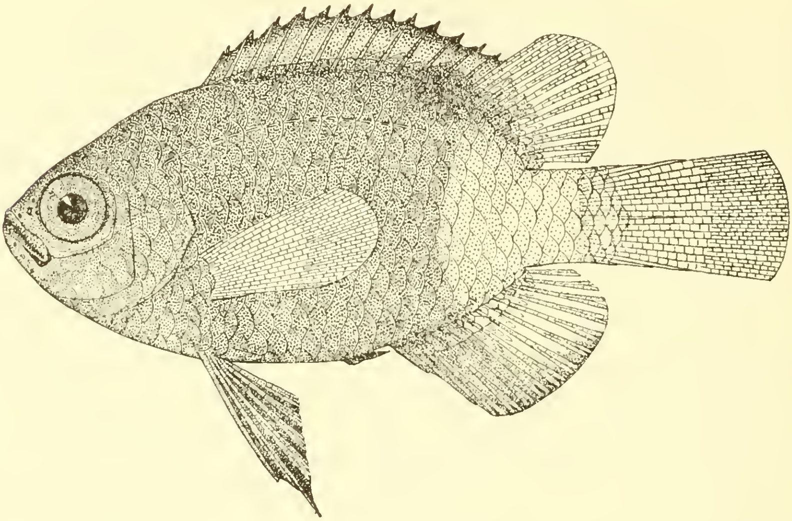

FIGURE 93.—*Pomacentrus traceyi*, new species, holotype, USNM 141310, from Rongelap Atoll, Marshall Islands. Drawn by A. M. Awl.

POMACENTRUS TRACEYI, new species

FIGURE 93

Holotype.—USNM 141310, Rongelap Atoll, Rongelap Island near north end, lagoon coral head at depth of 18 feet, July 25, S-46-286, Brock, Herald, and Kohler, 36 mm.

Paratypes.—USNM 141309, same data as holotype, 10 specimens, 27 to 36.6 mm.; USNM 141308, Bikini Atoll, Arji Island, 100 yards off shore, lagoon coral area at depths 0 to 40 feet, poison and spear, Aug. 7, S-46-308, Brock and Herald, 1 specimen, 40 mm.

Description.—Counts and measurements of the holotype are given first, followed by the range of variation noted in the paratypes (see table 88 for measurements expressed in thousandths of standard length): Dorsal fin rays XIII,11 (XIII,10 to 12); anal rays II,12 (II,12); pectoral rays ii,14 (ii,13 or 14); scale rows from upper edge of gill opening to base of caudal rays, 26 (26), with 3 (2½ or 3) between lateral line and origin of spiny dorsal, 9 (9) between lateral line and origin of anal; upper part of lateral line with 14 or 15 (14 to 16) tubular scales; gill rakers 6+1+14 (1 paratype).

Depth of body 2.1 (2.08 to 2.1); length of head 3.16 (3.0 to 3.2); both in standard length. Snout 4.57 (4.3 to 4.6); eye 2.65 (2.4 to 2.7); preorbital width 13.5 (12.5 to 13.8); length of upper jaw 3.17 (3.0 to 3.2); postorbital part of head (hind margin of eye to upper edge of gill opening) 2.72 (2.7 to 3.2); interorbital width 3.57 (3.9); depth of caudal peduncle 2.08 (1.95 to 2.1); length of pectoral fin 1.07 (1.0 to 2.6), of pelvic fin 0.93 (0.9 to 0.94), of 6th dorsal spine 2.08 (1.8 to 2.0), of upper caudal rays 0.91 (0.9 to 1.0), of lower caudal rays 0.97 (1.0 to 1.2); all in length of head (tip of snout to hind margin of opercular membrane). Depth of caudal peduncle in its length 0.85 (0.8 to 0.9); angle of snout profile with lengthwise axis of body 47 (45 to 49) degrees.

Teeth of jaws biserial, those of outer row large, cylindrical basally, flattened distally, with rounded tips, those of inner row smaller and more slender, sharply pointed, fitting closely into spaces between teeth of outer row; snout scaled forward to nostrils, which are close to lip, so that only tip of snout is left naked; preorbital naked, with concave lower edge; suborbitals scaled; cheek with 3 rows of scales; preopercle with posterior margin naked and very finely serrate (some specimens show serrations only near angle and in all the serrations are so small they may be seen only with difficulty, unless magnified); opercle with flat, triangular spine (curved downward in type); spines of dorsal increasing in length to 6th or 7th which are longest, then decreasing in length only slightly to last, soft dorsal and anal outlines rounded, caudal angular, very shallow fork; pelvics pointed; pectorals rounded.

Color in alcohol.—Head and body dark reddish brown, each scale on head and back with a round blue spot on base, scales of sides with a narrow vertical blue basal bar, sometimes this bar constricted, forming 2 oval spots; a squarish intensely black spot about size of eye on basal portion of last 3 dorsal spines and first 2 soft rays and on back above lateral line; anus and genital papilla intensely black; caudal peduncle bright yellow; spiny dorsal membranes dusky brown, with narrow black distal margin; soft dorsal and caudal fin pale or pale yellow; anal fin dusky brown on spines and anterior rays, posterior rays pale, colorless; pelvics brown; pectoral pale, its base not darker than rest of body; no dark axillary spot.

Remarks.—This species differs from all others of the genus *Pomacentrus* by its few dorsal rays, the large black spot on last 3 dorsal spines, entirely colorless caudal, and lack of black pigment on pectoral base. Named *traceyi* after Dr. Joshua I. Tracey, of the U. S. Geologica Survey.

Table 88.—*Measurements of* Pomacentrus traceyi *in thousandths of standard length.*

Characters	Holotype (USNM 141310)	Paratype (USNM 141309)	Paratype (USNM 141309)
Standard length in mm	36	27.4	39.7
Depth of body	472	474	482
Length of head	348	329	315
Length of snout	69	77	68
Length of eye	119	139	118
Width of preorbital	24	24	25
Length of upper jaw	100	102	103
Length of postorbital	117	120	98
Width of interorbital	89	84	81
Depth of caudal peduncle	153	157	161
Length of pectoral fin	292	----------	307
Length of pelvic fin	342	362	338
Length of sixth dorsal spine	153	168	171
Length of upper caudal rays	349	318	343
Length of lower caudal rays	328	285	310
Length of caudal peduncle	181	172	201

POMACENTRUS BIFASCIATUS Bleeker

Plate 88,C

Pomacentrus bifasciatus Bleeker, Nat. Tijdschr. Nederl.-Indië vol. 6, p. 330, 1854 (type locality, Larantuka, Flores).

SPECIMENS STUDIED

Guam: 2 specimens, 19 and 31.7 mm. in standard length.

Description.—Dorsal rays XIII,14 or 15; anal II,14; pectoral ii,15 or 16; transverse scale rows from upper edge of gill opening to base of caudal rays 28, with 3 between lateral line and origin of spiny dorsal, 10 between lateral line and origin of anal, upper part of lateral line with 16 tubular scales; gill rakers 9+1+19.

Depth of body 2.1 to 2.2; length of head 1.6 to 3.0; both in standard length. Snout 3.3 to 4.0; eye 2.6 to 2.9; preorbital width 10.7 to 18.0; length of upper jaw 3.1 to 3.3; postorbital part of head (hind margin of eye to upper edge of gill opening) 2.9 to 3.0; interorbital width 3.5 to 4.0; depth of caudal peduncle 1.9 to 2.3; length of pectoral fin 1.2, of pelvic fin 0.9 to 1.4, of 6th dorsal spine 1.9 to 2.3; caudal rays broken on both specimens; all in length of head (tip of snout to hind margin of opercular bone). Depth of caudal peduncle in its length 0.9 to 1.0; angle of snout profile with lengthwise axis of body 45 to 47 degrees.

Teeth of jaws biserial, those of outer row larger, pointed, inner row smaller, fitting closely into spaces between teeth of outer row; scales on top of head covering interorbital area, not extending farther forward than anterior margin of eye, not reaching nostrils, snout naked; preorbital and suborbital narrow (less than diameter of pupil), naked, entire; both inferior and posterior margins of preopercle naked; dorsal spines gradually increasing in length to 5th, 6th, and 7th, which are subequal, then decreasing slightly to last; soft dorsal and anal outlines angular, caudal apparently only slightly forked, pelvics pointed, pectoral rounded.

Color in alcohol.—Pale yellowish pink with two black saddles; snout dusky; interorbital with indistinct dusky band, a black band about equal in width to diameter of eye on nape before first dorsal spine, narrowing ventrally and becoming indistinct on upper portion of opercle, or dividing and descending along anterior portion of opercle and on preopercle to cheek; second band extending from distal portion of membranes between 6th dorsal spine and first soft dorsal ray, narrowing and fading ventrally to about middle of sides, anus black, fins all pale or sometimes slightly dusky basally.

Remarks.—Bleeker has stated in a description of this species that one band descends from the nape and the other from the soft dorsal (Nat. Verh. Holl. Maatsch. Wetensch. ser. 3, vol. 2, p. 89, 1877). His figure (Atlas ichthyologique . . . , vol. 9, pl. 401, fig. 3) shows the second band descending from the middle of the soft dorsal rather than from the posterior part of the spiny dorsal. It may be that our specimens represent a different species but they have been called *P. bifasciatus* because they possess the other features that Bleeker gave as characteristic of this species: Lower limb of preopercle without scales, interorbital region scaled, and median spines of dorsal longer than posterior spines. We have not found this combination of characters in any of the other banded species of *Pomacentrus.*

POMACENTRUS MELANOPTERUS Bleeker

PLATE 90,A

Pomacentrus melanopterus BLEEKER, Nat. Tijdschr. Nederl.-Indië, vol. 3, p. 562, 1852 (type locality, Amboina).

SPECIMENS STUDIED

Rongelap Atoll: Rongelap Island near north end, lagoon coral head at depth of 18 feet, July 25, S-46-286, Brock, Herald & Kohler, 1 specimen, 75 mm.

Description.—Dorsal fin rays XIII,14; anal rays II,13; pectorals ii,16; transverse scale rows 27 from upper edge of gill opening to base of caudal rays, with 3½ between lateral line and origin of spiny dorsal, 10 between lateral line and origin of anal; upper part of lateral line with 18 tubular scales; gill rakers 6+1+15.

Depth of body 1.9; length of head 3.5; both in standard length. Snout 4.1; eye 3.2; preorbital width 10.7; length of upper jaw 3.0; postorbital part of head (hind margin of eye to upper edge of gill opening) 3.7; interorbital width 2.95; depth of caudal peduncle 1.8; length of pectoral fin 0.85, of pelvics 0.9, of 13th dorsal spine 1.5; of upper caudal rays 0.8, of lower caudal rays 0.8; all in length of head (tip of snout to posterior margin of opercular membrane). Depth of caudal peduncle in its length 0.96; angle of snout profile with lengthwise axis of body 57 degrees.

Teeth of jaws biserial, those of outer row larger, rounded or bluntly pointed, those of inner row small, slender, curved, pointed; snout scaled to a point just anterior to nostrils; preorbital and suborbital naked, suborbital narrow, about half width of preorbital; scales extending to margin of preopercle, which is finely serrate; dorsal spines increasing in length to last, which is longest; soft dorsal and anal outlines angular; pectoral long, rounded tip.

Color in alcohol.—Lips blackish, top of head dark brown, cheeks, opercles, breast grayish brown, scales of back and sides with broad dark brown membrane and distinctly paler base, so that fish appears crosshatched and with indistinct lengthwise lines on posterior sides and caudal peduncle; spiny dorsal membranes dark brown basally, the free parts of distal portion blackish; soft dorsal black basally, distal portion of anterior half of fin dark brown, posterior rays brown, membranes pale; anal similarly colored, the last 6 rays paler; caudal black basally, becoming gradually paler brown distally, rays brown to tips; pelvics dark purplish brown; pectoral with large intensely black spot across base, then a pale whitish area, distal portion of rays brown, membrane clear, inner pectoral base also black, axil dark brown.

Remarks.—Bleeker's figure of this species (Atlas ichthyologique . . . , vol. 9, pl. 402, fig. 6) shows the suborbital serrated but in his remarks on this species (Nat. Verh. Holl. Maatsch. Wetensch., ser. 3, vol. 2, p. 56, 1877) he states that the suborbital is not serrated.

POMACENTRUS COELESTIS Jordan and Starks

PLATE 83,D

Pomacentrus coelestis JORDAN and STARKS, Proc. Calif. Acad. Sci., 3rd ser., Zool., vol. 2, pp. 383–384, pl. 21, 1901 (type locality, Wakanoura in Kii, Japan).

SPECIMENS STUDIED

Bikini Atoll: Ion Island, August 7, 1946, Univ. Washington, 14 specimens, 21.5 to 40 mm.; Bikini or Rongelap or Kwajalein Atolls, August 17 to Sept. 28, 1946, Bradley and Carter, Univ. Washington, 1 specimen, 49 mm.

Description.—Dorsal rays XIII,13 to 15, usually XIII,14; anal II,15, rarely II,16; pectoral rays ii,15 to 16, rarely iii,16; scale rows from upper edge of gill opening to base of caudal fin 28 or 29 (usually 28), with 3 scales from lateral line to dorsal origin, 8 or 9 (usually 9) from lateral line to anal fin origin; gill rakers 6+1+14 or 15 (2 counts); pores in lateral line 17 or 18, usually 17.

Depth of body 2.5 to 2.8; length of head 2.9 to 3.4; both in standard length. Snout 4.0 to 4.3; eye 2.8 to 3.0; least preorbital width 14 to 15; snout tip to rear edge of maxillary 2.9 to 3.0; postorbital part of head 2.1 to 2.2; interorbital width 3.2 to 3.3; depth of caudal peduncle, 2.1 to 2.5; length of pectoral fin 1.2 to 1.3, of pelvic fin 1.2 to 1.3, of last dorsal spine 1.8 to 2.2, of longest upper caudal ray 0.8 to 1.1, of lower caudal ray 0.8 to 1.1; all in length of head. Least depth of caudal peduncle in its length 1.1; angle of snout profile with lengthwise axis of body 50 to 55°.

Teeth of jaws biserial forward, conical, compressed, the inner row represented by small teeth between the larger ones; scales extend forward to a line between front of orbits; orbital ring naked, suborbital and preorbital smooth-edged, no spines; preopercular margin scaled ventrally, probably naked posteriorly; dorsal spines gradually increasing in length to last.

Color in alcohol.—Background coloration dark brown dorsally from rear of base of soft dorsal anteriorly (including head) and ventrally to about level of lower edge of pectoral base; this dark brown coloration may contain very indistinct pale spots, about one on each scale; below the dark brown coloration lower sides and body ventrally are abruptly white or pale, this extending posterodorsally to include caudal peduncle, caudal fin and soft dorsal fin distally; a small black spot on opercle, sometimes indistinct on blackish brown specimens; spiny dorsal dark brown; anal fin white or pale with distal margin edged with black line; pectoral pale or white, basally dark brown; pelvics light dusky or whitish. No blue or white lines on head.

Remarks.—This species is closest to *Pomacentrus caeruleus*, which has naked orbital ring, no spines on preorbital or suborbital, and an elongate body (depth about 2.5 to 3.0 in standard length). In coloration *coelestis* is dark brown anterodorsally and white posteroventrally, these colors contrasting distinctly; whereas, in *caeruleus* the ventral parts are dusky and on the head there are numerous blue or white reticulated lines absent in *coelestis*. The soft rays of both dorsal and anal fins average about one ray more in *coelestis* than in *caeruleus*, see table 89.

TABLE 89.—*Counts made on certain species of* Pomacentrus

Species	Dorsal rays							Anal rays					Pectoral rays				Scales from upper edge of gill opening to base of caudal fin			
	XII	XIII	XIV	12	13	14	15	11	13	14	15	16	16	17	18	19	27	28	29	30
caeruleus																				
Philippines	1	9	------	------	8	2	------	10	2	8	------	------	------	6	4	------	2	8	------	------
coelestis																				
Japan (on figure of holotype)	------	1	------	------	------	1	------	1	------	1	------	------	------	------	1	------	------	1	------	------
Marshall Islands	------	13	1	------	1	12	1	14	------	------	13	1	------	5	12	1	------	9	3	------
pavo																				
Samoan Islands	------	9	1	------	10	------	------	10	10	------	------	------	3	7	------	------	------	------	9	1
Philippine Islands	------	12	------	2	10	------	------	12	11	1	------	------	4	8	------	------	------	3	9	------
Marshall Islands	------	11	------	------	10	1	------	11	10	1	------	------	4	6	1	------	------	1	9	1

Family LABRIDAE

By Leonard P. Schultz

This large and variable family was represented in the Marshall and Marianas Islands by numerous genera and species. Since the number of pelvic rays are always I,5, they are not recorded for the species. In counting pores in the lateral line, the abrupt arch opposite the rear base of dorsal fin is represented in the formula by a middle figure, for example, 18+2+6, with 18 pores in dorsal lateral line, 2 pores in arch, and 6 in peduncular lateral line. The number of pores in the lateral line may not represent the number of vertical scale rows from upper edge of gill opening to base of caudal fin, since in those forms with an interrupted lateral line there may be some overlapping of lateral lines. The pores were counted to the base of the caudal fin. Scales above lateral line were counted to the base of the first soft dorsal ray and below to anal fin origin.

The following key is intended only to distinguish those genera found in the Marshall and Marianas Islands.

KEY TO THE GENERA OF LABRIDAE

1*a*. Preopercular edge denticulate posteriorly, the edge is free posteriorly as much as ventrally; gill membranes joined across isthmus, forming a broad free fold.
  2*a*. Lateral line continuous not interrupted.
    3*a*. Lateral line gently sloping to midlengthwise axis of caudal peduncular region; branched caudal rays 6+6; pores in lateral line 27 to 35; pectoral rays ii,13 to 16; 2 pairs of canines in each jaw; sides of head and bases of median fins scaled.
      4*a*. Dorsal rays XII or XIII,6 to 8; anal III,8 to 10; pores in lateral line 27 to 29, with 2 scales above and 8 or 9 below it. **Choerodon** Bleeker
      4*b*. Dorsal rays XII,9 to 11; anal III,10 to 13; pores in lateral line 29 to 35, with 3 or 4 scales above and 10 to 13 below it. **Bodianus**[29] Bloch
    3*b*. Lateral line with abrupt drop or curve to midlengthwise axis of caudal peduncle; dorsal rays IX to XI,9 to 12; pectoral i or ii,10 to 12; branched caudal rays 5+5; pores in lateral line 15 or 16+2+6 or 7, with 2 scales above and 6 below lateral line----**Pteragogus** Peters
  2*b*. Lateral line interrupted; branched caudal rays 6+5; anal III,8 to 10; scales above lateral line 1 or 2 and 6 or 7 below it.
    5*a*. Dorsal rays IX,11; pectoral ii,12 or 13; pores in lateral line 14 or 15+5 to 7; enlarged canines at tips of upper and of lower jaws in two pairs, outer pair of upper jaw somewhat hooked backward. **Pseudocheilinops**, new genus

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[29] *Bodianus* Bloch, Naturgeschichte der ausländischen Fische, vol. 4, pp. 31, 33, 1790 (type species, *Bodianus bodianus* Bloch=*Labrus rufus* Linnaeus)

5*b*. Dorsal rays XI or XII,8 to 10; pectoral ii,13 or 14; pores in lateral line 16 to 18+5 to 7; a single pair of enlarged canines at tip of lower jaw and 3 pairs near tip of upper jaw, outer pair hooked backward.
Cirrhilabrus Temminck and Schlegel

1*b*. Preopercular edge if free, not denticulate; instead it is smooth.

6*a*. Lateral line interrupted; gill membranes free from isthmus forming a broad free fold across it.

7*a*. Pores in lateral line 49 to 68+5 to 22; dorsal rays VIII to X,12 to 15, first two spines flexible; pectoral ii,9 to 11; branched caudal rays 5+5; tip of both jaws with one pair of enlarged canines; preopercular edge free as much posteriorly as ventrally.
Cymolutes Günther

7*b*. Pores in lateral line 14 to 22+5 to 9.

8*a*. Lower jaw greatly elongate, the dentaries reaching posteriorly to behind gill membranes, and both jaws excessively protractile; cheek and opercle fully scaled, no free edge to preopercle; dorsal rays IX or X,9 or 10; anal III,8; pectoral ii,10; pores in lateral line 14 or 15+8 or 9; 1 or 2 pairs of canines at front upper jaw and 1 pair at front of lower jaw______________**Epibulus** Cuvier

8*b*. Dentaries normal, not as in 8*a*.

9*a*. Operculum and cheek fully scaled, no free preopercular edge; 2 rows of scales below eye, 2 or 3 large scales covering opercle and interorbital covered with a few big scales; dorsal rays IX or X,9 or 10; anal III,8; pectoral ii,9 or 10; branched caudal rays 6+5; pores in lateral line 13 to 15+6 or 7, with 2 scales above lateral line and 6 below it; 2 or 3 pairs of small canines at front of both jaws, nearly vertical and opposing each other___________________**Wetmorella** Fowler and Bean

9*b*. Operculum and cheek not fully scaled, preopercular edge free posteriorly as much as ventrally.

10*a*. Anal rays III,12 or 13; dorsal rays IX,12 to 14; pores in lateral line 20 to 22+5 or 6, with 2 scales above and 9 to 11 below lateral line; a single pair of enlarged canines at front of both jaws, the lower pair fitting between upper when mouth is closed.

11*a*. First two dorsal spines flexible; spines III to IX pungent.

12*a*. Membrane between all dorsal spines connected near their tips and membrane between dorsal spines II and III not incised; first 2 dorsal rays may be elongate and bannerlike or as short as the pungent spines.
Xyrichthys Cuvier

12*b*. Membrane between dorsal spines II and III deeply incised, usually to base of spine III, or the first two flexible spines are completely separated from spines III to IX.

13*a*. Membrane between dorsal spines II and III incised to base of third__________**Hemipteronotus** Lacepède

13*b*. First two dorsal spines flexible, elongate, forming a distinct fin, completely separated from third spine.
Iniistius Gill

11*b*. First dorsal spine flexible; spines II to IX pungent.
Novaculops, new genus

10*b*. Anal rays III,8 or 9; branched caudal rays 6+5; lateral line with 2 scales above and 6 below it.

14*a*. Anal rays III,8; pectoral ii,10; dorsal rays IX or X,8 to 10; pores in lateral line 14 to 16+6 to 9; a single pair of enlarged canines at tip of lower jaw and 1 or 2 pairs near tip of upper jaw.................**Cheilinus** Lacepède

14*b*. Anal rays III,9; pectoral ii,11 to 15; dorsal rays IX,11 or 12; pores in lateral line 14 to 18+5 to 7; small canines at front of upper jaw in 2 or 3 pairs directed obliquely forward and the outer one greatly enlarged and hooked backward; a single pair of canines at front of lower jaw. **Pseudocheilinus** Bleeker

6*b*. Lateral line continuous; dorsal spines VIII to X; branched caudal fin rays 6+6.

15*a*. Preopercular edge scaled over, no free edge; entire head scaled except area around mouth; lips very thick, plicate; dorsal rays IX,11; anal III,10; pectoral ii,11 to 13; pores in lateral line about 18 to 20+2+5 or 6, with 3 or 4 above and 10 or 11 below lateral line; the pair of canines widely spaced at front of both jaws; gill membranes joined to isthmus..................**Labrichthys** Bleeker

15*b*. Preopercular edge not completely scaled over, at least part of it free.

16*a*. Lower lip with a broad and deep concavity, on each side of which is a forward projecting fleshy lobe; lips not plicate or folded outward with median incision as in *Hemigymnus;* side of head scaled; preopercular edge free at the posteroventral angle only; dorsal rays IX,11; anal III,10; pectoral ii,11; pores in lateral line 20 to 40+5 to 13; the pair of canines at front of both jaws widely spaced, the upper pair fitting between lower when mouth is closed..................................**Labroides** Bleeker

16*b*. Lower lip normal, not incised as in 15*a*.

17*a*. Gill membranes joined to each other, free from isthmus, forming a broad free fold; pores in lateral line totaling 45 to 48, with 6 or 7 above and 10 to 14 below it; the lateral line running a straight course, without an abrupt bend, to caudal peduncle; preopercular edge free posteriorly nearly as much as ventrally; dorsal rays IX (rarely VIII),11 to 13; anal rays III,11 or 12, pectoral rays ii,10.................**Cheilio** Lacepède

17*b*. Gill membranes joined to the isthmus with or without a narrow free fold posteriorly over isthmus.

18*a*. Anal rays II,9 or 10; preopercular edge free posteriorly but not ventrally; dorsal rays IX,9 or 10; pectoral ii,11; pores in lateral line about 30+2+7, with 6 scales above and 13 below it; both lips thick anteriorly, somewhat plicate; head scaled posteriorly from behind eye..**Diproctacanthus**[30] Bleeker

18*b*. Anal rays III,10 to 13 (rarely 9 or 14); sometimes the first anal spine is minute, but it is not absent.

19*a*. Pores in lateral line 33 to 54+3 to 7+9 to 15; dorsal rays IX,11 or 12; pectoral ii,11 or 12; anal III,11 or 12; preopercular edge free posteriorly about as much as ventrally; head naked; dorsal and anal fins without scaly bases.

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[30] *Diproctacanthus* Bleeker, Proc. Zool. Soc. London, p. 415, 1861 (type species, *Labroides xanthurus* Bleeker).

20*a*. Canines project nearly straight forward, the pair in upper jaw flattish, with outer forward edge straight, incisorlike; pores in lateral line 33 to 34+4 to 6+10 or 11 with 6 or 7 scales above and about 19 below it; gill membranes joined to isthmus without a free fold. **Pseudanampses** [31] Bleeker

20*b*. Canines in upper jaw conical, in one or two pairs, curving anteroventrally, not incisorlike, the single pair in lower jaw curving anterodorsally; pores in lateral line 36 to 54+3 to 7+8 to 15 with 4 to 7 scales above and 19 to 32 below it------------------**Coris** Lacepède

19*b*. Pores in lateral line fewer than 32.

21*a*. Dorsal rays VIII,12 to 14; pectoral rays ii,12 to 15; pores in lateral line 19 or 20+1 or 2+5 or 6, with 3 or 4 above and 8 to 10 below it; preopercular edge free posteriorly but not ventrally.

22*a*. A single pair of forwardly curved canines at front of upper jaw; lower jaw with 1 or 2 pairs, the middle pair fitting between middle pair in upper jaw when mouth is closed; snout normal, not tubular. **Thalassoma** Swainson

22*b*. Canines in both jaws in 2 or 3 pairs, that oppose each other; snout elongate and somewhat tubular. **Gomphosus** Lacepède

21*b*. Dorsal rays IX,10 to 12; pores in lateral line 18 to 20+2+4 to 7.

23*a*. Canines in both jaws in 2 pairs, the outer pair of upper jaw strongly hooked outward and backward; free part of preopercular edge restricted to the posteroventral corner--------**Macropharyngodon** Bleeker

23*b*. Canines in both jaws not projecting much if any beyond other teeth or those in upper jaw in 1 or 2 pairs, and a single pair of canines in lower jaw; none of the canines hooked outward and backward; gill membranes joined to isthmus, sometimes with a free fold posteriorly.

24*a*. Teeth at front of both jaws small, not caninelike, not projecting obliquely forward, but nearly vertical, opposing each other; first anal spine minute, visible on dissection; head naked. **Stethojulis** Günther

24*b*. Canines or enlarged teeth at front of both jaws projecting obliquely forward; first anal spine not minute but notably shorter than second.

25*a*. Lips very thick, lower one split in the middle forming 2 lobes; gill membranes broadly joined to isthmus, restricting gill opening. **Hemigymnus** Günther

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[31] *Pseudanampses* Bleeker, Atlas ichthyologique . . ., vol. 1, p. 101, 1862 (type species, *Anampses geographicus* Cuvier and Valenciennes, designated by Whitley, Rec. Australian Mus., vol. 18, No. 3, p. 114, 1931, and by Fowler, Proc. Acad. Nat. Sci., Philadelphia, vol. 48, p. 162, 1946).

Ampheces Jordan and Snyder, Proc. U. S. Nat. Mus., vol. 24, p. 628, 1902 (type species, *Anampses geographicus* Cuvier and Valenciennes).

25*b*. Lips normal not incised.

26*a*. Canines at front of both jaws directed nearly straight forward the pair in lower jaw curved a little downward, the pair in upper jaw incisorlike, the outer margin straight or nearly so and forming a "cutting edge"; scales below lateral line 10 or 11. **Anampses** Quoy and Gaimard

26*b*. Canines not greatly enlarged, directed or curved obliquely forward and ending in a point, without straight edge; scales below lateral line 8 or 9________**Halichoeres** Rüppell

Genus CHOERODON Bleeker

Choerodon Bleeker, Natuur- en Geneesk. Arch. Neêrl.-Indië, vol. 4, p. 10, 1847 (type species, *Labrus macrodontus* Lacepède).

This genus may be distinguished by the following characters: Branched caudal fin rays 6+6; gill rakers about 14 to 18; dorsal rays XII or XIII,6 to 8, anal III,8 to 10; pectoral ii,13 to 16; pores in lateral line 27 to 29, the lateral line continuous, with 2 scales above to base of first soft dorsal ray and 8 or 9 below to anal origin; cheek with small scales partially embedded and in several rows; large scales on opercle and a row of scales on interopercle; interorbital, snout, and ventral side of head naked; dorsal and anal fins with a sheath of elongate scales basally; preorbital wider in adults than in the young; two pairs of enlarged canines at front of both jaws, the outer pair flaring a little outward and posteriorly, sometimes worn down to short stubs; sides of jaws with a uniserial row of teeth; gill membranes broadly joined, forming a broad free fold across isthmus; preopercular edge finely dentate in young, becoming less so in adults; preopercular edge free posteriorly and ventrally about equally.

CHOERODON ANCHORAGO (Bloch)

Plate 92,C

Sparus anchorago Bloch, Naturgeschichte der ausländischen Fische, vol. 5, p. 108, pl. 276, 1791 (no locality given).

SPECIMENS STUDIED

Guam: 1945, P. G. Frey, 6 specimens, 34 to 107 mm.

Description.—Dorsal rays XIII,7; anal III,9; pectoral ii,13, rarely ii,14; branched caudal rays 6+6; pores in lateral line 27 or 28, with two scale rows above lateral line to base of first soft dorsal ray and 8 or 9 scales to anal origin; gill rakers on first gill arch about 16.

Head 2.4 to 2.7; greatest depth 2.4 to 2.5; longest pectoral ray 3.8 to 4.0; snout tip to anus 1.6; snout to dorsal origin 2.3 to 2.4; all in the standard length. Snout 2.3 to 2.8; eye 3.4 to 4.7; postorbital length of head 2.0; fleshy interorbital space 3.5 to 4.3; longest pectoral ray 1.4 to 1.7; least depth of body 2.2 to 2.4; all in length of head.

Dorsal profile of snout forming an angle of 75 to 85 degrees with ventral contour of head; pectoral fin reaches to opposite 13th lateral line pore; first and second outer rays of pelvics longest, not reaching past anal origin; distal margin of caudal fin rounded in young, truncate in adults; dorsal spines all pungent.

Color in alcohol.—Background brownish, with a wedge-shaped white bar from area behind pelvic bases dorsally to lateral line; dorsal part of caudal peduncle pale; pectoral base blackish or dark brown. In the young there are three whitish bars across body, and the dorsal and anal fins are barred with dusky; pelvics dusky basally.

Genus PTERAGOGUS Peters

Pteragogus Peters, Arch. Naturg. vol. 21, p. 261, 1855 (type species, *Cossyphus opercularis* Peters).

Duymaeria Bleeker, Act. Soc. Indo-Néerl., vol. 1, p. 52, 1856 (type species, *Crenilabrus aurigarius* Richardson, designated by Jordan and Snyder, Proc. U. S. Nat. Mus., vol. 24, p. 623, 1902).

Labrastrum Guichenot, Rev. Mag. Zool., ser. 2, vol. 12, p. 152, 1860 (type species, *Ctenolabrus flagellifer* Cuvier and Valenciennes).

This genus may be recognized by the following characters: Branched caudal fin rays 5+5; lateral line continuous, pores 15 or 16+2+6 or 7, with 2 scales above lateral line to base of first soft dorsal ray and 6 scales below to anal origin; about 23 or 24 vertical scale rows to base of caudal fin; dorsal rays IX to XI,9 to 12; anal III,8 to 10; pectoral i or ii,10 to 12; 2 rows of scales below eye on cheek and 1 row on interoperculum; a row of elongate scales on basal part of dorsal and anal fins; opercle scaled; jaws equal, upper and lower jaws each with 2 pairs of enlarged canines, posterior pair hooked a little outward and backward; usually 1 to 4 canines at rear of toothed part of upper jaw, these canines lacking on juveniles; sides of jaws with a uniserial row of conical teeth; gill membranes free from isthmus, with a broad fold across it; posterior edge of preopercle finely toothed, the edge free posteriorly as much as ventrally; caudal fin rounded.

The distinguishing of species referable to this genus is difficult and uncertain because of sexual dimorphism and change in color pattern from juvenile to adult. Counts of fin rays, pores in lateral line, and measurements did not indicate differences of sufficient magnitude to permit more than 4 species to be recognized. All four species when adult, have from 1 to 4 canines at the corner of the mouth on the upper jaw, but these are absent in the young.

A study of the number of dentae on the preopercular edge, table 90, indicates clearly that for *P. flagellifera* the dentae increase in number with increase in size. Thus one must conclude that the number of dentae is a character that is not useful in the distinguishing of species in this genus.

TABLE 90.—*Correlation between dentae on edge of preopercle and standard length in* Pteragogus flagellifera

Number of dentae	Standard length in mm.										
	31–40	41–50	51–60	61–70	71–80	81–90	91–100	101–110	111–120	121–130	131–140
47–50										1	2
43–46								1			
39–42								1	1		1
35–38						1	5				1
31–34					2	1	1				
27–30		1	1	2		1					
23–26		1	2	2							
18–22	1	3	2								

TABLE 91.—*Counts for* Pteragogus flagellifera *and* P. guttatus

Species	Fin rays									
	Dorsal				Anal			Pectoral (total rays)		
	IX	X	10	11	III	8	9	12	13	14
flagellifera	39	--------	--------	39	39	1	38	1	50	2
guttatus	--------	11	10	1	11	--------	11	2	18	1

KEY TO THE SPECIES OF PTERAGOGUS

1*a*. Dorsal rays IX,11; opercle and cheek with narrow light and dark reticulations; plate 91,D---------- **P. flagellifera**[32] (Cuvier and Valenciennes)

1*b*. Dorsal rays X,10 (rarely X,11). See table 91.

 2*a*. White bar at base of caudal fin; 5 round dark spots or blotches on side of body but absent in juveniles; no dark bar with white edge below eye. **P. guttatus** (Fowler and Bean)

 2*b*. No white bar at base of caudal fin; no spots as in 2*a*; a distinct dark bar with white edges below eye and one on side of snout. **P. taeniops**[33] (Peters)

1*c*. Dorsal rays XI,9 or 10; opercle with dark ocellate spot. **P. opercularis**[34] (Peters)

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[32] *Ctenolabrus flagellifera* Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 13, p 240, 1839 (no locality given).

Probable synonyms are: *Ctenolabrus aurigarius* Richardson 1844, and *C. rubellio* Richardson 1844; *Crenilabrus nematopterus* Bleeker 1851; *C. enneacanthus* Bleeker, 1853; *C. spilogaster* Bleeker, 1854; *Cossyphus filamentosus* Peters, 1855; *Duymaeria japonica* Bleeker, 1856; *D. amboinensis* Bleeker, 1856; *D. caeruleomaculata* Günther, 1862.

[33] *Cossyphus taeniops* Peters, Arch. Naturg., vol. 21, p. 262, 1855 (type locality, Mossambique).

[34] *Cossyphus opercularis* Peters, Arch. Naturg., vol. 21, p. 261, 1855 (type locality, Mossambique).

PTERAGOGUS GUTTATUS (Fowler and Bean)

Plate 92,A

Duymaeria guttata Fowler and Bean, U. S. Nat. Mus. Bull. 100, vol. 13, p. 218, 1928 (type locality, Philippines, holotype (USNM 89969) examined).

SPECIMENS STUDIED

Rongelap Atoll, two miles west of Bush Island, dredge, depth 180 feet, June 21, 1946, S–46–232, W. R. Taylor, 1 specimen, 20 mm.

Description.—Dorsal X,10; anal III, 9; pectoral ii,11–ii,11; pores in lateral line 16+2+6, with 2 scales above and 6 scales below lateral line; dentae on preopercle 13.

Head 2.5; greatest depth 2.7; snout tip to anus 1.6; snout tip to dorsal origin 2.3; all in the standard length. Snout 3.7; eye 3.1; postorbital length of head 2.1; fleshy interorbital space 5.7; least depth of body 6.2; all in length of head.

Color in alcohol.—Background pale to whitish; a dark spot between dorsal spines I and II, and another at rear end of soft dorsal base; 3 or 4 dark spots just behind nape on back and a spot one scale row below dorsal origin; opercle with dusky blotch.

Remarks.—My identification of this small specimen is uncertain because of variability in color pattern and sexual dimorphism for the species referable to this genus. Although the lateral line appears to be interrupted, by means of a jet of compressed air, it was possible to note its continuation. One of the paratypes of *P. guttatus* also has an interrupted lateral line on one side, but can be traced by compressed air.

I have studied 11 specimens of this species and find the dentae on the preopercular edge vary from 13 to 25, with an increase in number of dentae on the larger specimens.

PSEUDOCHEILINOPS, new genus

Type species.—*Pseudocheilinops ataenia*, new species.

This new genus is most closely related to *Pseudocheilinus* but differs as indicated in the following key:

1*a*. Preopercular edge smooth; 2 or 3 pairs of small canines between the enlarged hooked pair near front of upper jaw; a single pair of enlarged canines at tip of lower jaw............................**Pseudocheilinus** Bleeker

1*b*. Preopercular edge finely serrate; a single pair of small canines between the enlarged hooked pair near front of upper jaw; two pairs of canines at tip of lower jaw, the outer pair largest....**Pseudocheilinops**, new genus

Remarks.—Named in reference to its similiarity to *Pseudocheilinus*.

Table 92.—*Counts for species of* Pseudocheilinus and Pseudocheilinops

Species	Fin rays												Pores in lateral line							
	Dorsal			Anal			Pectoral						Anterior part					Peduncular		
	IX	11	12	III	9	10	ii	11	12	13	14	15	14	15	16	17	18	5	6	7
Pseudocheilinus:																				
hexataenia	17	17	----	17	17	----	42	----	----	21	21	----	---	---	1	4	---	1	4	---
octotaenia	15	14	1	15	14	1	32	1	30	1	----	----	---	---	---	3	6	1	6	2
tetrataenia, new species	20	20	----	20	20	----	31	----	----	----	30	1	---	---	2	5	8	4	4	7
evandis	8	8	----	8	8	----	16	----	15	1	----	----	---	3	1	---	---	1	3	---
Pseudocheilinops:																				
ataenia, new species	5	5	----	5	5	----	10	10	----	----	----	----	1	4	---	---	---	3	1	1

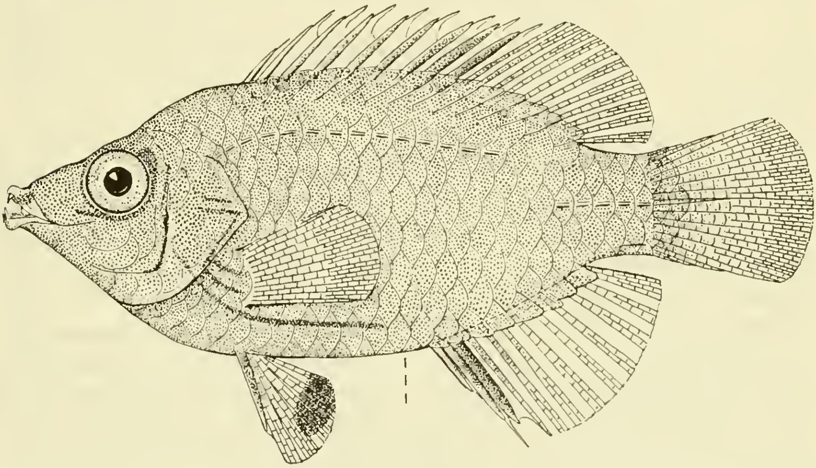

Figure 94.—*Pseudocheilinops ataenia*, new species, holotype, USNM 135555 from Talisse Island, Celebes. Drawn by A. M. Awl.

PSEUDOCHEILINOPS ATAENIA, new species

Figure 94

Pseudocheilinus hexataenia (in part) Fowler and Bean, U. S. Nat. Mus. Bull. 100, vol. 7, p. 341, 1928 (Philippine *Albatross* silk tag Nos. 2039 and 2094).

Holotype.—USNM 135555, Celebes, Talisse Island, Nov. 9, 1909, *Albatross* (silk tag No. 2039), standard length 41 mm.

Paratypes.—USNM 153396, Celebes, Talisse Island, Nov. 9, 1909, *Albatross*, 2 specimens, 38.7 to 39 mm.; USNM 153394, locality not given, *Albatross* Philippine Expedition 1907–8, 2 specimens, 25 to 36 mm.; USNM 153397, Molluccas, Gillolo Island, Gane Road, December 1, 1909, *Albatross*, 1 specimen (silk tag No. 2094), 33.5 mm.

Description.—Counts made on the holotype and paratypes are recorded in table 92.

Precision measurements were made on the holotype and one paratype and these data are expressed in thousandths of the standard length, respectively. Standard length 41 and 39 mm. Length of head 378 and 380; greatest depth 454 and 397; least depth of caudal peduncle 166 and 167; length of snout 139 and 131; diameter of eye 105 and 105; fleshy interorbital space 102 and 97; postorbital length of head 166 and 156; distance between anterior and posterior nostrils 17 and 13; preorbital distance 49 and 49; length of caudal peduncle 188 and 155; snout tip to anus 683 and 680; snout tip to dorsal origin 407 and 398. Length of longest ray of pectoral fin 210 and 216; of pelvic 207 and 185; length of first dorsal spine (longest) including fleshy filament 163 and 177; length of bony part of anal spine (longest) 173 and 185; length of longest ray of caudal 293 and 295, of soft dorsal 198 and 197, of soft anal 207 and 180.

Head 2.6 to 2.8; greatest depth 2.5 to 2.6; longest pectoral ray 3.9 to 5.1; snout tip to anus 1.5; snout tip to dorsal origin 2.4 to 2.6; all in standard length. Snout 2.8 to 3.1; eye 3.4 to 3.5; postorbital length of head 2.3 to 2.5; fleshy interorbital space 3.5 to 3.7; longest pectoral ray 1.8 to 1.9; least depth of caudal peduncle 2.1 to 2.3; all in length of head. Eye in fleshy interorbital space 0.8 to 1.0.

Dorsal profile of snout forming an angle of 60 to 68 degrees with ventral contour of head; pectoral fin reaches to opposite lateral line pore 8; first and second pelvic soft rays longest; caudal rounded; all spiny dorsal rays pungent, with short filaments at tips; second and third anal spines strong, of equal length; all anal spines with short filaments at tips. A single pair of small canines at symphysis of upper jaw between enlarged hooked canine at each side; two pairs of canines at tip of lower jaw, the outer pair largest; inside of canines occurs a couple of rows of conical teeth, sides of jaws with a uniserial row of small conical teeth; preopercular edge finely serrate.

Color in alcohol.—Body light tan; spines in all fins blue-green; a black spot near tips of inner soft pelvic rays; a brown spot on upper lip on each side of tip of snout; a few brown specks on body and brownish wavy lines in front of pectoral base and on lower sides anteriorly; opercular apparatus with a brownish line at rear edge of preopercle.

Color when alive.—(From *Albatross* silk tag 2094): "Dull wine red with narrow sulphur stripes. Dorsal spines indigo membranes hyaline wine, rays slightly dusky. Caudal rays pale indigo, membranes hyaline pink. Anal same as dorsal. Ventral spines indigo, indigo blotch across outer half of fin, tip pink. Pectoral hyaline pink. Iris scarlet."

Remarks.—This new species with ii,11 pectoral fin rays differs from all other closely related species all of which have more than ii,12 pectoral rays. The dark spot on the pelvic fins does not occur in any related species, all of which may be distinguished by means of the key.

Named *ataenia* in reference to the absence of the dark streaks on the upper sides.

Genus CIRRHILABRUS Temminck and Schlegel

Cirrhilabrus Temminck and Schlegel, Fauna Japonica, pt. 4, p. 167, pl. 86, fig. 3, 1845 (type species, *Cirrhilabrus temminckii* Bleeker, designated by Bleeker, Verh. Bataviaasch. Gen., vol. 25, p. 17, 1853).

Cheilinoides Bleeker, Nat. Tijdschr. Nederl.-Indië, vol. 2, p. 71, 1851 (type species, *Cheilinoides cyanopleura* Bleeker).

This genus may be recognized by the following characters: Branched caudal rays 6+5; dorsal rays XI,9 rarely X or XII, and rarely 8 or 10; anal III,9 rarely 8 or 10; pectoral rays ii,13 rarely ii,14; lateral line pores 16 to 18+5 to 7, with 2 scales above lateral line (usually second scale extends on dorsal fin) to base of first soft dorsal ray and 6 or 7 below to anal origin; cheek with two rows of scales; interorbital space convex; posterior edge of preopercle finely denticulate and edge free as far posteriorly as ventrally; mouth oblique; 2 pairs of small canines at front of upper jaw, with an enlarged canine each side that is hooked posteroventrally; lower jaw with a pair of enlarged canines on each side of symphysis; the pair of canines in lower jaw fits between pairs 1 and 2 in upper jaw when mouth is closed; sides of both jaws with a uniserial row of small conical teeth becoming biserial at front of jaws behind canines; gill membranes free from isthmus, with a broad free fold across isthmus; basal part of median fins with a row of elongate scales.

Table 93.—*Counts recorded for species referable to* Cirrhilabrus

Species	Fin rays												Pores in lateral line				
	Dorsal					Anal				Pectoral			Anterior part			Peduncular	
	XI	XII	8	9	10	III	8	9	10	ii	13	14	16	17	18	5	6
temmincki	15	1	1	14	1	16		14	2	30	27	3	6	5	1	7	5
jordani	4		1	3		4	1	3		6	6		1	2		1	2
cyanopleura	1			1		1		1		2	2			1		1	

CIRRHILABRUS TEMMINCKI Bleeker

PLATE 93,F,G

Cirrhilabrus temminckii BLEEKER, Verh. Bataviaasch. Gen., vol. 25, p. 17, 1853 (type locality, Japan; on *Cirrhilabrus* Temminck and Schlegel, Fauna Japonica, pt. 4, p. 167, pl. 86, fig. 3, 1845).

SPECIMENS STUDIED

Bikini Atoll: 1 station, 1 specimen, 26 mm. in standard length.
Rongelap Atoll: 3 stations, 12 specimens, 18 to 46 mm.
Philippines: 3 specimens (USNM 153284 and 153285).

Description.—Counts made on certain species of *Cirrhilabrus* are recorded in table 93.

Head 2.3 to 3.0; greatest depth 3.4 to 3.7; longest pectoral ray 4.7 to 5.0; snout tip to anus 1.5 to 1.8; snout tip to dorsal origin 2.4 to 2.7; all in standard length. Snout 3.5 to 3.7; eye 3.2 to 4.0; postorbital length of head 2.0 to 2.1; fleshy interorbital space 3.6 to 3.4; longest pectoral ray 1.7 to 2.0; least depth of body 2.4 to 2.5; all in length of head. Eye in fleshy interorbital space 0.7 to 1.0.

Dorsal profile of head forming an angle of 45 to 52 degrees with ventral contour of head; pectoral fin reaches to a point opposite lateral line pores 9 or 10; second soft ray of pelvics short in young, elongate in adults; distal margin of caudal fin rounded; all rays of spiny dorsal pungent; second and third anal spines of about equal length and strength.

Color in alcohol.—Background coloration light tan; dorsal edge of pectoral base blackish; spines bluish.

Adults (longer than 35 mm.): scales in dorsal part of body with little white lengthwise lines; row of scales above lateral line may have 6 white spots, sometimes an additional light spot on each scale; each scale in row just below peduncular lateral line with white spot; some of the other scales may have a white spot; a dusky streak near middle of anal and dorsal fins is present or absent.

Young (40 mm. and shorter): Background light tan without white spots on scales or dusky streaks on median fins; a dark spot occurs at dorsal edge of caudal peduncle at base of caudal fin; dark spot at upper edge of pectoral base prominent.

Ecology.—This little understood species was taken most frequently below the tidal zone in water as deep as 40 feet, where it preferred coral heads. Specimens between 46 and 72 mm. were mature.

Remarks.—I am unable to construct a satisfactory key to the species of *Cirrhilabrus* because of the lack of a series of specimens that might represent the described species, *C. cyanopleura* (Bleeker); *C. lyukuensis* Ishikawa; *C. solorensis* Bleeker; *C. heterodon* Bleeker and *C. jordani* Snyder. Among these species, specimens of which I have studied indicate that *cyanopleura* differs from *temmincki* in having the scales behind the pectoral on side of body with black edges. *C. jordani* may be distinguished from *temmincki* and *cyanopleura* by its very elongate soft dorsal and anal rays, with a blackish edge on anal fin.

The problem concerning the elongate nature of the second pelvic ray cannot be solved by a study of the specimens available to me at present. In *temmincki* the following relationship occurs:

Standard length in mm.	*Length of second pelvic ray in mm.*	*Sex*
39	6	♀
43	10	♂
46	10	♂
73	23	♀

This indicates an increase in length of the second pelvic ray with age.

Genus CYMOLUTES Günther

Cymolutes Günther, Ann. Mag. Nat. Hist. London, ser. 3, vol. 8, p. 387, 1861 (type species, *Julis praetextata* Quoy and Gaimard).

This genus deviates from most of the other labrid genera in having 5+5 branched caudal fin rays instead of the usual number of 6+6 or 6+5. Other characteristics are: Gill rakers on first gill arch 5 to 7+1+9 to 12; dorsal rays normally IX,12 to 15, occasionally VIII or X, the first two spines flexible, others pungent; anal II or III (usually III), 11 to 13, first anal spine small, sometimes absent; pectoral ii,9 to 11, usually 10; body compressed; lower lip with a fold of tissue on the side; dorsal profile of head strongly convex; interorbital space convex; nostrils small, anterior one a minute short tube; jaws equal, a pair of enlarged canines at front of each jaw, the pair in lower jaw fitting between those of upper jaw (canines in both jaws exposed) when mouth is closed; conical teeth in a band at sides of both jaws, with the outer row largest; corner of jaws without the posterior canine tooth; gill membranes free from isthmus, with a wide free fold across it; posterior edge of preopercle free posteriorly as much as ventrally; head naked; bases of all fins, except caudal, naked.

Only a single species in the genus *Cymolutes* is recognized in most of the general contributions on the labrid fishes of the tropical Indo-Pacific oceans. My present study of the specimens referable to this genus in the U. S. National Museum clearly indicates that, on the basis of the number of fin rays and color pattern, at least 3 distinct species are distinguishable. They are analyzed in tables 94, 95 and in the following key:

1*a*. Anal rays III,12, rarely 11 or 13; dorsal rays IX,13 rarely 12.
C. praetextatus (Quoy and Gaimard)

1*b*. (See 1*c*.) Anal rays II or III,12; dorsal rays IX,12.
C. torquatus[35] (Cuvier and Valenciennes)
1*c*. Anal rays III,13; dorsal rays usually IX,14 or 15.
C. lecluse[36] (Quoy and Gaimard)

TABLE 94.—*Comparison of certain characters for the species of* Cymolutes

Character	Species		
	praetextatus	*lecluse*	*torquatus*
Black bar just behind head	Absent	Absent	Present.
Small black ocellate spot just below lateral line opposite about lateral line pores 22 or 23.	Absent	Present on adults, probably lacking on young.	Absent.
Black line on membrane between dorsal spines I and II.	Present	Present	Absent.
Black spot at dorsal edge of base of caudal fin.	Present on those shorter than 89 mm. standard length.	Usually present on all sizes.	Absent.
Dark brown vertical lines on sides over anal fin.	Absent	Absent	Present on young and half grown.
Number of soft anal rays (normally)	12	13	12.
Number of soft dorsal rays (normally)	13	14	12.

CYMOLUTES PRAETEXTATUS (Quoy and Gaimard)

PLATE 92,E

Julis praetextata QUOY and GAIMARD, *in* Voyage de . . . l'*Astrolabe* . . . , Zoologie, vol. 3, p. 712, pl. 15, fig. 4, 1834 (type locality, "Mauritius").

Cymolutes praetextatus (non Quoy and Gaimard), BLEEKER, Atlas ichthyologique . . . , vol. 1, p. 146 (in part), pl. 31, fig. 1, 1862.—DAY, Fishes of India, vol. 2, p. 409 (in part), pl. 90, fig. 1, 1878.

SPECIMENS STUDIED

Bikini Atoll: 1 station, 18 specimens, 39 to 90 mm. in standard length.
Rongelap Atoll: 2 stations, 2 specimens, both 44 mm.

Description.—Certain counts are recorded in table 95.

Head 2.8 to 3.2; greatest depth 3.6 to 3.7; longest pectoral ray 5.6 to 5.8; snout tip to anus 1.8 to 1.9; snout to dorsal origin 3.4 to 3.5; all in standard length. Snout 2.2 to 2.7; eye 4.0 to 4.9; postorbital

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[35] *Xyrichthys torquatus* Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 14, p. 54, pl. 392, 1839 (type locality, "Surinam" [East Indies]).

Cymolutes tateyamaensis Sakamoto, Journ. Imp. Fish. Inst., vol. 26, No. 1, pp. 11–13, fig. 1, 1930 (type locality, Tateyama Bay, Japan).

Probably *Xyrichthys novaculoides* Bleeker and *Novacula xyrichthyoides* Bleeker are synonyms of this species. Plate 392 of Cuvier and Valenciennes shows 1 more soft ray in dorsal and anal fins than are given in the text. The presence of only II anal spines in the plate follows closely my counts.

[36] *Xyrichthys lecluse* Quoy and Gaimard, Voyage autour du monde . . . sur . . . l' *Uranie* et la *Physicienne*, Zoologie, p. 284, pl. 65, fig. 1, 1824 (type locality, Hawaiian Islands).

Xyrichthys microlepidotus Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 14, p. 52, 1839 (type locality, Oahu).

Novacula microlepis Vaillant and Sauvage, Rev. Mag. Zool., vol. 3, p. 284, 1875 (type locality, Hawaiian Islands).

TABLE 95.—*Counts recorded for species of* Cymolutes

Species	Fin rays																Gill rakers on first arch							
	Dorsal							Anal					Pectoral				Above angle			At angle	Below angle			
	VIII	IX	X	12	13	14	15	II	III	11	12	13	ii	9	10	11	5	6	7	1	9	10	11	12
lecluse:																								
Hawaiian Islands	1	11				11	1		12			12	16		16			3	4	7	1	4	2	
praetextatus:																								
Philippine Islands		16		1	15				16		15	1	19		17	2			2	2		2		
Phoenix Islands		10			10				10		10		18	2	14	2		1	1	2	1	1		
Tonga Islands		1			1				1		1		2		2									
Marshall Islands		7	1	1	7				8	1	7		15	2	13		3	1		4		3	1	
torquatus:																								
Philippine Islands		4		4				2	2		4		8		8		1	3		4		2	1	1
Zanzibar		2		2				1	1		2		4	1	3		1		1	2	2			
Japan [1]		1		1				1			1		1		1									

Species	Pores in lateral line																		Vertical scale rows												
	Anterior part										Peduncular part																				
	49 50	51 52	53 54	55 56	57 58	59 60	61 62	63 64	65 66	67 68	15	16	17	18	19	20	21	22	71 72	73 74	75 76	77 78	79 80	81 82	83 84	85 86	87 88	89 90	91 92	93 94
lecluse:																														
Hawaiian Islands			1	5			2					2		1	1	2	1	1				3	1	1	3					
praetextatus:																														
Philippine Islands	2											1		1									1	1		1		1		
Phoenix Island		2	1	2	2	1						1	3	2	1	1					1									
Tonga Island			1										1									2	3	1	1	1				
Marshall Islands		2	2	2							3		2			1			1		4	3	2							
torquatus:																														
Philippine Islands				1	1			2				1	2		1								1	1		1		1		
Zanzibar					1					1		1			1									1						1
Japan								1					1										1							

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[1] From original description of *Cymolutes tateyamaensis* Sakamoto 1930.

length of head 2.1 to 2.2; interorbital space 5.0 to 5.5; longest pectoral ray 2.0 to 2.1; least depth of body 2.8 to 2.9; all in length of head. Eye in fleshy interorbital space 0.8 to 1.0.

Dorsal profile of snout forming an angle of 60 degrees, in young, and 85 degrees, in adults, with ventral contour of head, the profile becoming more arched and steep on the largest specimens; pectoral fin reaches to opposite the 24th to 26th lateral line pores; outer soft rays of pelvic fins longest; distal margin of caudal fin truncate or a little rounded.

Color in alcohol.—Background coloration whitish ventrally, slightly dusky dorsally; sides over anal fin with about 11 to 13 alternating white and light dusky narrow bars, the width of the lighter bars about equal to diameter of pupil; back with traces of about 6 or 7 dusky saddles, these sometimes not present; a small black dot at base of upper caudal fin rays in specimens shorter than 80 mm.; a black line on membrane between dorsal spines I and II; peritoneum black.

Ecology.—This species was observed living over sandy bottoms, often hiding in shallow holes or burrows. The bottom sand was soft with areas of gravelly coral debris of a very porous nature. This fish was not observed in close association with growths of corals or of algae. The short intestine indicates a diet of animal food.

Genus EPIBULUS Cuvier

Epibulus Cuvier, Regne animal, ed. 2, vol. 2, p. 264, 1817 (type species, *Sparus insidiator* Pallas).

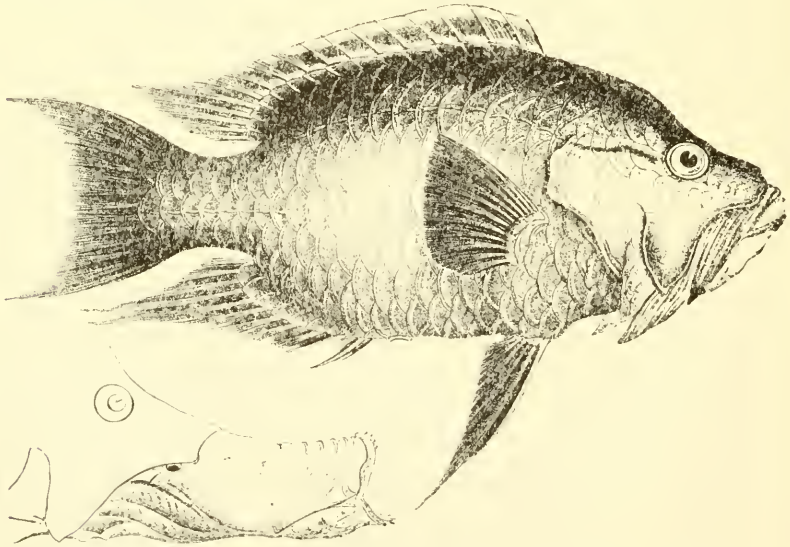

Figure 95.—*Epibulus insidiator* (Pallas), drawing from Wilkes Exploring Expedition.

EPIBULUS INSIDIATOR (Pallas)

Figure 95

Sparus insidiator Pallas, Spicilegia zoologica, vol. 8, p. 41, pl. 5, fig. 1, 1770 (type locality, Java).

SPECIMENS STUDIED

Bikini Atoll: 3 stations, 3 specimens, 123 to 200 mm. in standard length.
Eniwetok Atoll: 1 station, 2 specimens, 92 to 108 mm.
Rongerik Atoll: 1 station, 1 specimen, 110 mm.
Rongelap Atoll: 4 stations, 11 specimens, 21 to 215 mm.

Description.—Dorsal rays usually IX,10 occasionally X,9; anal rays III,8; pectoral ii,10; pelvics I,5; branched caudal fin rays 6+5; dorsal lateral line with 14 pores (rarely 15) and peduncular lateral line with 8 or 9 pores; vertical scale rows 21, with 2 scales above lateral line to base of last dorsal spine and 6 from lateral line to anal origin; gill rakers on first gill arch 5+12; 3 rows of scales on cheek.

Head 2.4; greatest depth 2.1 to 2.2; longest pectoral ray 4.7 to 4.8; snout tip to anus 1.5 to 1.6; snout to dorsal origin 2.2 to 2.3; all in standard length. Snout 2.7 to 3.2; eye 4.5 to 6.2; postorbital length of head 2.0; interorbital space (bony) 5.6 to 6.0; longest pectoral fin ray 1.8 to 2.0; least depth of body 2.4 to 2.5; all in length of head. Distance between anterior and posterior nasal openings 6 or 7 in snout; eye 0.9 to 1.5 in interorbital space.

Body strongly compressed; snout short; dorsal profile of head concave in front of eyes, convex at occiput; interorbital space strongly convex; nostrils minute, anterior one in a minute tube; upper jaw rather long, the maxillary reaching to a vertical line through pupil, dentary excessively elongate, reaching posteriorly past gill membranes on underside of head; jaws greatly protractile, capable of being thrust far forward; teeth, short, conical, in a single row in both jaws, the anterior pair in both jaws enlarged canines curving forward; sometimes 2 pairs are enlarged in upper jaw; gill membranes joined across isthmus to form a broad free fold; head scaled, except snout, preorbital, and jaws; body scaled, bases of median fins in a scaly sheath; paired fins naked; lateral line interrupted, dorsal lateral line follows dorsal contour of body and ends near rear part of base of soft dorsal fin, then begins again two scale rows below on midlengthwise axis of body; pectoral fin reaches to opposite seventh lateral line scale and the second branched ray from dorsal edge is longest; pelvics reach to or past anus in young, and in adults the outer rays are greatly elongated, reaching at least to base of first soft anal ray; in large adults the soft rays of dorsal and anal fins are greatly elongate, reaching to opposite rear tips of shortest caudal fin rays; outer rays of caudal fin on large adults elongated and filamentous; rear margin of caudal fin of young truncate, that of large adults lunate.

Color in alcohol.—Background coloration brown, fins blackish or dark brown; pectoral fin blackish, except broad distal edge, which is clear or white on specimens longer than 200 mm., or in young and half grown the pectoral fin is pale or clear; each scale on upper parts of body with a vertically elongate dark spot; peritoneum pale.

On specimens 77 and 80 mm. in standard length the caudal peduncle and caudal fin are abruptly paler than brownish body forward of a vertical line through rear edge of bases of dorsal and anal fins.

The two Marshall Island specimens, 200 and 215 mm., have a large light brown blotch in front of dorsal origin that extends below base of dorsal fin to lateral line thence gradually fades as it extends posteriorly to below base of soft dorsal; a broad dark brown band behind eye, and a narrow dark line forward on snout in front of eye; posterior margins of scales blackish; dorsal fin with dark edge distally, then submarginally white, with a transverse or lengthwise narrow dark band through middle of fin, basal third of dorsal pale or light brown; dark blotch on membrane between first and third dorsal spines.

The two specimens 35 and 37 mm. in standard length have traces of four vertical bars, whereas the five smaller ones, 21 to 30 mm., have four distinct narrow white vertical bars with brown edges, the first from front of spiny dorsal behind pectoral base then behind pelvic bases, second from front of soft dorsal base to front of soft anal, third between rear edges of dorsal and anal bases, fourth at base of caudal fin; three black spots in dorsal, one in anal, one in each pelvic fin; five narrow white streaks, with dark edges radiating from eye, one on snout, one across interorbital space, two behind eye, and one below across cheek, meeting its fellow ventrally on underside of head; another white streak with dark edges from pectoral base across breast in front of pelvics.

Color when alive.—Dark brown or blackish.

Ecology.—This species was not common on the shallow reefs and seemed to prefer deeper water associated with coral growths.

Genus WETMORELLA Fowler and Bean

Wetmorella Fowler and Bean, U. S. Nat. Mus. Bull. 100, vol. 7, p. 211, 1928 (type species, *Wetmorella philippina* Fowler and Bean).

Schultz and Marshall (Proc. U. S. Nat. Mus., vol. 103, pp. 439–447, figs. 52–54, pl. 12, 1954) published a review of this genus and described as new two species and one subspecies. Their study indicates, without doubt, that Fowler (p. 358, 1931) and Weber and de Beaufort (Fishes of the Indo-Australian Archipelago, vol. 8, p. 82, 1940) were in error in referring *Wetmorella philippina* to the synonymy of *Cheilinus fasciatus* (Bloch).

The genus *Wetmorella* is characterized by dorsal rays IX or X,9 or 10; anal III,8; pectoral ii,9 or 10; branched caudal rays 6+5; lateral line interrupted with 13 to 15+6 or 7 pores to base of caudal fin. Jaws equal or nearly so; premaxillary protractile; teeth short, conical, in a single row in both jaws, those near front of both jaws becoming gradually enlarged, the two pairs nearest tip of jaws largest; gill membranes broadly joined across isthmus, forming a free fold; head with a distinctive scale pattern composed of large characteristically shaped scales, arranged in a pattern similar to that shown in figure 96. The chief variation in scales on the head is that there may be 2 median scales on the snout instead of 1; cheek with 1 or 2 rows of scales, below which on subopercle may occur another row and a single scale below that; 2 or 3 rows of scales behind eye, including the gill cover; a row of large scales occurs above dorsal lateral line, then a second row along spiny dorsal fin, mostly covering the spines except tips, becoming much smaller along soft dorsal rays, almost disappearing on base of last ray; anal fin with a similar sheath of scales; basal half of caudal fin enclosed in large scales; axillary pelvic scale present, short; interorbital space flattish and a little convex; dorsal profile of head nearly straight, forming an angle of 40 to 55 degrees with ventral contour of head; maxillary covered by preorbital when mouth is closed. A blackish ocellate spot in pelvics, and at rear of soft dorsal and anal fins; white bar behind eye and one on caudal peduncle.

Counts for the species of *Wetmorella* are recorded in table 96.

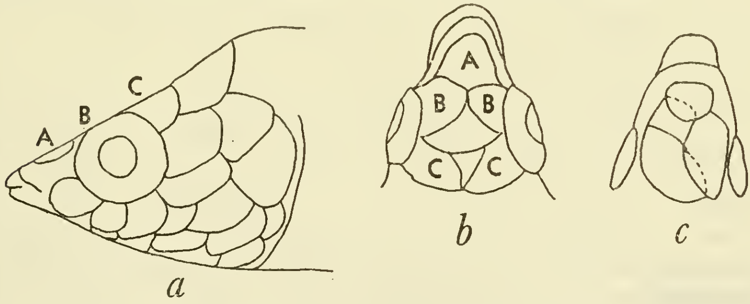

Figure 96.—Sketch of the arrangement of the scales on the head of the holotype of *Wetmorella philippina bifasciata* Schultz and Marshall.

KEY TO THE SPECIES OF WETMORELLA

1*a*. Greatest width of white bar between rear of bases of soft dorsal and of soft anal fins across caudal peduncle is contained about 2.0 to 4.7 times (3.8 to 4.7 in Red Sea specimens) in least depth of caudal peduncle; white bar on caudal peduncle completely encircles it; young only, with white bar from front of spiny dorsal through pectoral base, thence to pelvic base; white bar behind eye meets its fellow near occiput.

2*a*. Caudal fin plain dusky, except in smallest specimens there occur 2 narrow black cross bars, remainder of fin pale or white; some of the scales on the middle of the sides have black dots; greatest depth about 2.4 to 2.5 in standard length---------- **W. ocellata** Schultz and Marshall

2*b*. Caudal fin with a few black spots on middle rays at about three-fourths their length distally; greatest depth 2.4 to 3.0.

3*a*. Greatest width of peduncular white bar 2.3 to 3.4 in least depth of caudal peduncle; no white bar in front of ocellate spot in soft dorsal and in front of spot in soft anal fins; plate 93,C.
W. philippina philippina Fowler

3*b*. Greatest width of peduncular white bar 3.8 to 4.7 in least depth of caudal peduncle; white bar present in front of ocellate spot in soft dorsal and in front of spot in soft anal fins.
W. philippina bifasciata Schultz and Marshall

1*b*. Greatest width of white bar on caudal peduncle between rear of bases of soft dorsal and of soft anal fins contained about 6 to 10 times in least depth of caudal peduncle; greatest depth about 2.8 to 2.9.

4*a*. A white bar from behind ocellate spot on soft dorsal passes in front of ocellate spot in soft anal fin; a white bar from bases of third and fourth dorsal spines passes behind pectoral base, thence to just behind pelvic base; posterior third of caudal fin with a black band, but rear margin of caudal fin is edged with white; the white bar on caudal peduncle occurs as a saddle ventrally and does not extend on dorsal part of caudal peduncle; plate 93,D------- **W. albofasciata** Schultz and Marshall

4*b*. No white bar passing between ocellate spot in soft dorsal and that in soft anal; a narrow white bar extends from in front of ocellate spot in soft dorsal to in front of that in soft anal fin; caudal fin plain dusky, edged with white distally; a white bar between orbits in the interorbital space; plate 93,E------------ **W. triocellata** Schultz and Marshall

TABLE 96.—*Counts recorded for species of* Wetmorella.

Species	Fin rays											Lateral line pores				
	Dorsal				Anal		Pectoral			Branched caudal		Upper			Lower	
										Dorsal lobe	Ventral lobe					
	IX	X	9	10	III	8	ii	9	10	6	5	13	14	15	6	7
philippina philippina	3	1	1	3	4	4	7	1	6	4	4	2	1	1	2	2
philippina bifasciata	2	----	----	2	2	2	2	----	2	2	2	2	----	----	2	----
ocellata	12	----	----	12	12	12	12	----	12	3	3	----	5	2	3	4
albofasciata	1	----	----	1	1	1	2	----	2	1	1	----	----	1	----	1
triocellata	1	----	----	1	1	1	2	----	2	1	1	----	----	1	1	----

WETMORELLA OCELLATA Schultz and Marshall

PLATE 93,A,B

Wetmorella ocellata SCHULTZ and MARSHALL, Proc. U. S. Nat. Mus., vol. 103, p. 444, pl. 12,D,E, (type locality, Rongelap and Bikini Atolls, Marshall Islands).

SPECIMENS STUDIED

USNM 112368, holotype, Rongelap Atoll, Kieshiechi Island, lagoon, depth 20 feet, July 24, 1946, S–46–285, Brock and Herald, standard length 38.5 mm.

USNM 112369 to 112372; paratypes, Bikini Atoll, 10 specimens, 23 to 57 mm., Univ. Washington, paratype, Bikini Atoll, Amen Island, 1 specimen, 43 mm.

Description.—Dorsal rays IX,10; anal III,8; pectoral ii,10; pelvics I,5; branched caudal fin rays 6+5; pores in lateral lines 14 or 15+6 or 7; scales above lateral line 2, below lateral line to anal origin 6; vertical scale rows 20 or 21; gill rakers on first arch about 6+9.

Certain measurements made on the holotype and two paratypes, expressed in thousandths of the standard length, are recorded in table 96.

Body compressed, the greatest depth opposite middle of spiny dorsal base; snout normal; dorsal profile of head straight or nearly so, forming an angle of 40 to 46 degrees with ventral contour of head and body; interorbital space slightly convex; nostrils small, the anterior one tubular; a vertical line through rear nasal opening passes through front edge of eye; jaws approximately equal; maxillary reaches to a vertical line through front nostril; maxillary covered by preorbital when mouth is closed; dentary normal; premaxillary protractile; teeth short, conical, in a single row in both jaws, those near front of both jaws becoming gradually enlarged, the 2 pairs nearest tip of jaws largest, and when mouth is closed, those of lower jaw fitting between the two opposite teeth in upper jaw and not by pairs of teeth; gill membranes broadly joined across isthmus and forming a free fold; head with a distinctive scale pattern composed of large scales with definite shapes as follows: Cheek with a single row of enlarged scales, below which on subopercle is another row, and a single scale below the latter; 3 rows behind eye, including gill cover; dorsal surface of head scaled forward to snout just in front of orbits, the 2 anteriormost scales median in position, then 3 in middle of interorbital space, followed by 2 larger ones between rear of orbits, then about 5 scales to dorsal fin origin; above dorsal lateral line is a row of large scales, then a second row along spiny dorsal fin, mostly covering the spines except tips, the row becoming much smaller along soft rays and almost disappearing on base of last ray; anal fin with a similar sheath of scales; basal half of caudal fin enclosed in large scales; axillary scale of pelvic short; pectoral fin reaches to opposite about 7th scale of lateral line; lateral line interrupted, beginning again 2 scale rows below on caudal peduncle; 4th pectoral ray usually longest; pelvics reaching or nearly reaching anus; caudal fin rounded.

Color in alcohol.—Background coloration light brownish to brownish, with a brown-edged white bar across caudal peduncle just behind rear of bases of soft dorsal and soft anal fins, and another brown-edged white bar just behind eye from side of head to nape; three prominent black ocellate spots, one at front of soft dorsal, another at front of soft anal, and the largest occupying each pelvic fin and the underlying part of the body opposite the pelvic fins; no white bar across interorbital space; middle of upper lip dark barred. The two smallest specimens, 23 and 25 mm., probably represent a juvenile color pattern: In addition to the white bar behind the ocellate spots there is in front of them another white bar that extends from bases of last dorsal spines to bases of anal spines; another white band extends from first two dorsal spines just behind pectoral base to pelvics; caudal fin white with two narrow cross bars, the distal margin of fin white.

Ecology.—This interesting labrid was taken only at depths of about 20 to 40 feet in the lagoon among coral heads. It was not seen in the intertidal zone of the reefs.

Remarks.—The closest relative of this species is *W. philippina* from which it differs in lacking black pigment spots in the caudal fin; *ocellata* has a plain dusky caudal fin in the adult, and none of the specimens of *ocellata* has even a trace of black spots in the caudal fin. After studying several hundred species of fishes of the tropical Indo-Pacific in numerous families we place a great deal of confidence in the color pattern differences such as occur in the Chaetodontidae, Labridae, Serranidae, and other families. Larger series will make it possible to determine the exact status of these forms. Among our 12 specimens of *ocellata* there is little variation in color pattern except that which normally occurs between small (young) specimens and the large (adult) specimens.

Genus XYRICHTHYS Cuvier

Xyrichthys Cuvier, Mem. Mus. Hist. Nat. Paris, vol. 1, pp. 317, 329, 355, 1815 (type species, *Xyrichtys cultratus* Cuvier=*Coryphaena novacula* Linnaeus).

Novacula Cuvier, Regne animal, ed., vol. 2, p. 265, 1817 (type species, *Coryphaena novacula* Linnaeus).

Amorphocephalus Bowdich, Excursions in Madeira and Porto Santo . . ., p. 237, 1825 (type species, *Amorphocephalus granulatus* Bowdich=*Coryphaena novacula* Linnaeus).

Novaculichthys Bleeker, Proc. Zool. Soc. London, p. 414, 1861 (type species, *Labrus taeniourus* Lacepède).

Dimalacocentrus Gill, Proc. Acad. Nat. Sci. Philadelphia, vol. 15, p. 223, 1863 (type species, *Novacula kallasoma* Bleeker).

Semachlorella Fowler and Bean, U. S. Nat. Mus. Bull. 100, vol. 7, p. 367, 1928 (type species, *Julis bifer* Lay and Bennett=*Novacula kallasoma* Bleeker=*Labrus taeniourus* Lacepède).

KEY TO THE GENERA RELATED TO XYRICHTHYS

1a. First two dorsal spines flexible and spines III to IX pungent.
  2a. Membrane between all dorsal spines connected near their tips and membrane between dorsal spines II and III not incised; first two dorsal rays may be elongate and bannerlike or as short as the pungent spines.......................................**Xyrichthys** Cuvier
  2b. Membrane between dorsal spines II and III deeply incised, usually to base of spine III, or the first two flexible spines are completely separated from the pungent spines III to IX; preorbital distance 1.0 to 1.8 in postorbital length of head.
    3a. Membrane between dorsal spines II and III incised to base of third. **Hemipteronotus** Lacepède
    3b. First two dorsal spines, flexible, elongate, forming a distinct fin completely separated from the third spine.............**Iniistius**[37] Gill
1b. First dorsal spine flexible, spines II to IX pungent; vertical line through front of eye behind rear corner of mouth, least preorbital distance 2 to 2.5 in postorbital length of head........**Novaculops**,[38] new genus

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[37] *Iniistius* Gill, Proc. Acad. Nat. Sci. Philadelphia, vol. 14 (1862), p. 143, 145, 1863 (type species, *Xyrichthys pavo* Cuvier and Valenciennes).

I have studied all the specimens of this genus in the U. S. National Museum and am able to distinguish 4 species. All recent authors have considered *I. pavo* (Cuvier and Valenciennes) and *I. pavoninus* (Cuvier and Valenciennes) as synonymous; however, as is usually the case, closely related species from Mauritius and from the Hawaiian Islands are distinct. The original description indicates the chief difference; *pavo* has 2 or 3 rows of scales on the cheek, whereas *pavoninus* has only a single row under the eye.

The following key distinguishes the 4 species studied by me:

KEY TO THE SPECIES OF INIISTIUS

1a. Cheek below eye with 2 or 3 rows of scales; blackish dorsal spot in oblique scale row passing lateral line pore 8; no groove across cheeck posteriorly from corner of mouth (Mauritius).........I. PAVO[a] (Cuvier and Valenciennes)
1b. Cheek below eye with a single row of scales.
  2a. Blackish dorsal spot in oblique scale row passing lateral line pore 8; no groove across cheek posteriorly from corner of mouth.
    3a. Body with 4 broad dark vertical bars, separated by paler interspaces; dorsal fin with or without 1 to 3 black spots. I. PAVONINUS[b] (Cuvier and Valenciennes)
    3b. Body and head very dark brown or blackish, no bars; fin blackish (Hawaiian Islands)...I. NIGER[c] (Steindachner)
  2b. Blackish dorsal spot in oblique scale row passing lateral line pore 7; a distinct but shallow linelike groove posteriorly across cheek from corner of mouth; body not barred (Japan)................I. DEA[d] (Temminck and Schlegel)

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[a] *Xyrichthys pavo* Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 14, p. 61, pl. 391, 1839 (type locality, Isl de France).

One specimen from Mauritius (USNM 130976), studied by me.

[b] *Xyrichthys pavoninus* Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 14, p. 63, 1839 (type locality, Hawaiian Islands).
Novacula tetrazona Bleeker, Nat. Tijdschr. Nederl.-Indië, vol. 17, p. 169, 1858–59 (type locality, Bali), Atlas ichthyologique . . ., vol. 1, p. 149, pl. 30, fig. 1, 1862.
Iniistius mundicorpus Gill, Proc. Acad. Nat. Sci. Philadelphia, p. 145, 1862 (type locality, Cape St. Lucas, Mexico; neotype (USNM 7338), Cape St. Lucas, collected by J. Xantus).
Iniistius leucozonus Jenkins, Bull. U. S. Fish. Comm., vol. 19 (1899), p. 54, fig. 11, 1901 (type locality, Hawaiian Islands).
Iniistius cacatua Waite, Rec. Australian Mus., vol. 4, p. 41, pl. 7, 1901 (type locality, Lord Howe Island).

[c] *Novacula (Iniistius) nigra* Steindachner, Anz. Denkschr. Akad. Wiss. Wien, 1900, No. 16, p. 176, 1900 (type locality, Honolulu); Denkschr. Akad. Wiss. Wien, vol. 70, p. 505, pl. 4, fig. 2, 1900 (Honolulu).
Iniistius verater Jenkins, Bull. U. S. Fish. Comm., vol. 19 (1899), p. 55, fig. 12, 1901 (type locality, Hawaiian Islands)

[d] *Xyrichthys dea* Temminck and Schlegel, Fauna Japonica, pt. 4, p. 171, pl. 87, 1845 (type locality, Japan).

[38] Type species, *Novaculichthys woodi* Jenkins, Bull. U. S. Fish. Comm., vol. 19 (1899), p. 52, fig. 8, 1900 (type locality, Honolulu).

N. entargyreus Jenkins (Bull. U. S. Fish. Comm., vol. 19 (1899), p. 53, fig. 9, 1900) from Honolulu is a synonym of *N. woodi;* diagnosis based on 7 specimens in the U. S. National Museum.

This genus may be recognized by the following characters: Branched caudal fin rays 6+6, the outer branched ray weakly divided, and in very small specimens sometimes unbranched; gill rakers on first gill arch about 5 to 8+1+10 to 13; dorsal rays IX,12 to 14, the first two spines flexible, sometimes elongate, bannerlike, connected by membrane with third dorsal spine; anal III,12 or 13; pectoral rays ii,10 or 11; a row of scales under eye and usually 2 scales on upper part of opercle; body compressed; lower lip with a broad fold of tissue on the side; dorsal profile of head steep, convex; interorbital space strongly convex; nostrils small, anterior one a minute tube; jaws equal; a pair of enlarged canines at front of each jaw, the pair in lower jaw curved dorsally and fitting between the pair in upper jaw when mouth is closed; canines of upper jaw curving downward; an outer row of enlarged conical teeth at side of each jaw and a narrow inner band of smaller ones; no posterior canine at corner of mouth; gill membranes free from isthmus, with a broad free fold across isthmus; posterior edge of propercle free posteriorly as much as ventrally; bases of fins except caudal, naked.

The two species referable to this genus in the central and western tropical Indo-Pacific may be distinguished by the following key:

1*a*. Dorsal rays IX,13 occasionally IX,14; anal III,13; pectoral rays ii,10; first two dorsal spines of normal length; background coloration pale, with brownish blotches or spots along midlengthwise axis of side, whitish and brown bands extend behind eye, and one forward from eye to snout; pelvics pale; plate 94,D................**X. macrolepidotus** (Bloch)

1*b*. Dorsal rays IX,12; anal III,12; pectoral ii,11, rarely ii,10; first two dorsal spines flexible, elongate and bannerlike in young, becoming of normal length in adult; color of young whitish with irregular dark brown lines, and 8 or 9 brown lines radiating from eye, these reduced to 4 from posterior side of eye of adult; head whitish; adults with broad white bar at base of caudal fin, distal half dark; each scale with whitish center, otherwise dark; pelvics dark brown; dorsal and anal fins barred; sometimes a blackish bar in axil of pectoral fin. **X. taeniourus** (Lacepède)

XYRICHTHYS TAENIOURUS (Lacepède)

PLATE 94,A,B,C

Labrus taeniourus LACEPÈDE, Histoire naturelle des poissons, vol. 3, pp. 448, 518, pl. 29, fig. 1, 1802 (type locality, "Great Equatorial Ocean").

Labrus hemisphaerium LACEPÈDE, Histoire naturelle des poissons, vol. 4, pp. 53, 160, 1802 (type locality, "Great Equatorial Ocean").

Julis vanikolensis QUOY and GAIMARD, *in* Voyage de . . . l'*Astrolobe* . . ., Zoologie, vol. 3, p. 704, pl. 20, fig. 1, 1834 (type locality, Vanikoro).

Novacula hoedti BLEEKER, Act. Soc. Sci. Indo-Neërl., vol. 1, p. 59, 1856 (type locality, Amboina; ref copied).

Julis bifer Lay and Bennett, Fishes *in* Zoology of Captain Beechey's voyage . . ., p. 64, pl. 18, fig. 2, 1839 (type locality, Oahu).

Novacula kallasoma Bleeker, Act. Soc. Sci. Indo-Neërl., vol. 8, p. 51, 1860 (type locality, Amboina).

SPECIMENS STUDIED

Bikini Atoll: 2 stations, 3 specimens, 93 to 163 mm. in standard length; 3 lots, Univ. Washington, 4 specimens, 43 to 191 mm.

Rongerik Atoll: 2 stations, 2 specimens, 59 and 114 mm.; 1 lot, Univ. Washington, 1 specimen, 39 mm.

Eniwetok Atoll: 2 stations, 2 specimens, 44 and 73 mm.; 1 lot, Univ. Washington, 2 specimens, 56 and 108 mm.

Guam: 1 lot, 1 specimen, 158 mm.

Saipan: 1 lot, 3 specimens, 42 to 58 mm.

Description.—Counts are recorded in table 97.

Head 2.8 to 3.0; greatest depth 2.8 to 3.0; longest pectoral ray 5.0 to 5.2; snout tip to anus 2.0 to 2.1; snout to dorsal origin 3.8 to 3.9; all in standard length. Snout 2.8 to 3.8; eye 4.2 to 6.5; postorbital length of head 1.8; fleshy interorbital space 5.3 to 5.8; longest pectoral ray 1.8 to 2.0; least depth of body 2.0 to 2.2; all in length of head. Eye in fleshy interorbital space 0.8 to 1.5.

Dorsal profile of snout forming an angle of 80 to 86 degrees with ventral contour of head; pectoral fin reaches to opposite tenth or eleventh lateral line pores; outer rays of pelvics sometimes elongate; distal margin of caudal fin a little rounded; the first two spiny dorsal rays are elongate and bannerlike on the young, but begin to shorten as the adult color pattern develops between lengths of 45 to 60 mm.; some specimens 95 mm. in length still have the first two rays elongate. The following measurements indicate this change:

Standard length (mm.)	*Length (in mm.) of longest first or second dorsal spine*	*Standard length (mm.)*	*Length (in mm.) of longest first or second dorsal spine*
39	17	96	22
42	18	100	12
43	19	107	14
44	19	108	15
45	16	108	15
47	26	110	13
49	14	114	22
56	15	128	13
58	13	158	17
59	26	160	17
64	28	163	25
73	10	167	18
93	12	190	23
95	22		

Color in alcohol.—Adult (standard lengths of 73 to 163 mm.) background coloration of body brownish, that of head whitish; center of each scale white; head with two white bordered brown streaks curving downward across operculum, one from lower edge of eye to rear corner of preopercle and the other from rear edge of eye across opercle toward base of pectoral; two other white-bordered brown streaks extend obliquely posterodorsally from rear of eye; a white bar on basal half of caudal fin; distal half barred with brown; black on membranes between dorsal spines I to III; dorsal and anal fins barred with brown spots on a white background; tips of anal rays white; base of pectoral fin brown, distally white; a black bar in axil of pectoral; pelvics dark brown; breast whitish.

The transition from the juvenile color pattern (*bifer*) to that of the adult occurs at lengths of from about 45 to 60 mm.

Immature (standard lengths of 38 to 59 mm.) background coloration whitish, with about 8 or 9 brown lines, radiating from eye; body with several vertically arranged brown lines; pelvics light brownish; distal half of caudal fin slightly dusky.

Three specimens, 56 to 59 mm. in standard length, still have 9 brown lines radiating from eye, the long bannerlike first two dorsal spines, but the scales are outlined with brown lines, the dorsal and anal fins are becoming brownish; pelvics dark brown; base of caudal white, distally brownish.

A 73 and a 95 mm. specimen have the adult color pattern, except for two extra short brown bars at lower front corner of eye.

Color when alive.—In adults the head is whitish tinged with pinkish yellow, the light spots on center of scales are creamy-white; light bar across base of caudal fin whitish, tinged with yellow; breast pink; light areas on dorsal fin light yellowish white, and light areas on anal whitish; the dark colors are dark brown to blackish; iris orange. The bar in axil of pectoral is black.

Ecology.—This is an uncommon species and was not taken frequently at any station. It preferred areas of abundant coral and algal growths.

Remarks.—It should be noted that the series of specimens before me clearly indicates that the juvenile state (described as *bifer* and *kallasoma*) changes to the adult *taeniourus* color pattern at lengths from about 45 to 60 mm.

Genus HEMIPTERONOTUS Lacepède

Hemipteronotus Lacepède, Histoire naturelle des poissons, vol, 3, p. 214, 1802 (type species, *Hemipteronotus quinque-maculatus* Lacepède=*Coryphaena pentadactylus* Linnaeus).

My study of the specimens referable to this genus has indicated a considerable amount of misunderstanding about the species, especially the limits of variability in color pattern and the scales on the cheek. The analysis of the various species of the tropical Indo-Pacific indicates that at least three of these species described from the Hawaiian Islands are distinct from those species recognized elsewhere in the tropical Indo-Pacific. For each species studied, the dark dorsal spot appears to be fixed in location with little variability, although its size has limited variation. The white patch on the side (red when alive) is not always well preserved in alcohol but seems to be present on most of the species. There is no notable variation in number of fin rays or scales for any of the species referable to this genus.

This genus may be recognized by the following characters: Branched caudal fin rays 5 or 6+5 or 6, the outer ray weakly divided or not divided; gill rakers on first gill arch 5 to 7+1+10 to 14; dorsal rays IX,12, the first two spines flexible, the second spine connected to third by a deeply incised membrane; anal III,12; pectoral rays ii,10 rarely ii,11; lateral line pores 20 to 22+5 or 6 (usually 5); 2 (sometimes a third, smaller) scales above lateral line to base of first soft dorsal ray and 9 to 11 (usually 10) scales from lateral line to anal origin; cheek with from one row of scales under eye to a patch extending all the way to corner of mouth; 2 or 3 scales on upper part of opercle; body compressed; lower lip with a broad fold of tissue on the side; dorsal profile of head steep, almost vertical in adults, convex; interorbital space strongly convex; front of head with fleshy keel; nostrils minute, anterior one a minute tube; jaws equal; a pair of enlarged canines at front of both jaws, these nearly vertical and curving outward a little; when mouth is closed the lower pair of canines fits between the upper pair; each jaw with an outer enlarged row of conical teeth and a narrow band of teeth anteriorly inside the outer row; gill membrane free from isthmus with a broad free fold across isthmus; posterior edge of preopercle free posteriorly and nearly as much ventrally; bases of all fins except caudal naked.

H. copei Fowler was described through error from Oahu, but Fowler (Mem. Bishop Mus. vol. 10. p. 366) refers it as a synonym of *Xyrichthys psittacus* (Linnaeus) of the western Atlantic.

Counts are recorded in table 97 for the species of *Hemipteronotus* and *Xyrichthys*.

TABLE 97.—*Counts recorded for species referable to* Hemipteronotus *and* Xyrichthys.

Genus and species	Fin rays											Pores in lateral line				
	Dorsal fin				Anal fin			Pectoral fin				Anterior part			Peduncular part	
	IX	12	13	14	III	12	13	ii	9	10	11	20	21	22	5	6
Hemipteronotus:																
melanopus	7	7	----	----	5	5	----	14	1	12	1	5	1	----	6	----
jenkinsi	1	1	----	----	1	1	----	2	----	2	----	----	1	----	1	----
umbrilatus	1	1	----	----	1	1	----	2	----	2	----	----	1	----	1	----
pentadactylus	3	3	----	----	3	3	----	6	----	5	1	3	----	----	3	----
hypospilus, new species	1	1	----	----	1	1	----	2	----	2	----	1	----	----	1	----
niveilatus	3	3	----	----	3	3	----	6	----	6	----	----	1	2	3	----
aneitensis	2	2	----	----	2	2	----	2	----	2	----	----	----	2	2	----
celebicus	1	1	----	----	1	1	----	2	----	1	1	1	----	----	----	1
Xyrichthys:																
taeniourus	18	18	----	----	18	18	----	34	----	1	33	16	----	----	16	----
macrolepidotus	7	----	6	1	7	----	7	14	----	14	----	6	----	----	5	1

KEY TO THE SPECIES OF HEMIPTERONOTUS OF THE TROPICAL INDO-PACIFIC OCEAN

1*a*. Patch of scales below eye reaching to opposite rear corner of mouth or below corner of mouth. Large cream-colored (red when alive) blotch behind pectoral fin usually present.

2*a*. Dark dorsal blotch (occasionally absent in preserved specimens) located on or opposite lateral line pores 8 to 10, sometimes extending farther below lateral line than above, this spot 1 to 3 scales wide and 2 to 5 scales high; adult males, sometimes females, with black spots on last two soft rays of anal or dorsal fins or on both; sometimes a dusky streak occurs along middle of side------**H. melanopus**[39] (Bleeker)

2*b*. Dark dorsal blotch located above and opposite lateral line pores 15 or 16, covering about 2 or 3 scales---------------**H. jenkinsi**[40] Snyder

2*c*. Dark blotch located on or below lateral line or wholly below lateral line.

3*a*. Dark blotch notably large, located on and below lateral line pores 7 to 11, covering 4 to 6 vertical scale rows and 6 or 7 lengthwise scale rows; posterior edges of scales in the black blotch whitish, and the whitish areas usually extending all the way to the anal region. **H. umbrilatus**[41] Jenkins

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[39] *Novacula melanopus* Bleeker, Act. Soc. Sci. Indo-Néerl., vol. 2, p. 82, 1857 (type locality, Amboina); Atlas ichthyologique . . ., vol. 1, p. 152, pl. 29, fig. 3, 1862.

Novacula spilonotus Bleeker, Act. Soc. Sci. Indo-Néerl., vol. 2, p. 83 (type locality, Amboina); Atlas ichthyologique . . ., vol. 1, p. 151, pl. 30, fig. 3, 1862.

Novacula twistii Bleeker, Nat. Tijdschr. Nederl.-Indië, vol. 10, p. 381, 1856 (type locality, Ternata); Atlas ichthyologique . . ., vol. 1, p. 152, pl. 29, fig. 1, 1862 (Ternata).

Novacula stockumi Reuvens, Notes Leyden Mus., vol. 16, p. 131, 1894 (type locality, Paternoster Islands).

Hemipteronotus evides Jordan and Richardson, Mem. Carnegie Mus., vol. 4, p. 196, pl. 72, 1909 (type locality, Formosa).

Hemipteronotus nigromaculatus Herre, Copeia, No. 1, p. 20, 1933 (type locality, Jolo, Philippine Islands).

Hemipteronotus baldwini Jordan and Evermann, Bull. U. S. Fish. Comm., vol. 22 (1903), p. 192, 1904 (type locality, Honolulu, T. H.).

The holotype (USNM 50644) and 6 paratypes (USNM 55359 and 12658) of *H. baldwini* along with other specimens from the Hawaiian Islands have been studied.

[40] *Hemipteronotus jenkinsi* Snyder, Bull. U. S. Fish. Comm., vol. 22 (1903), p. 530, pl. 10, fig. 10, 1904 (type locality, Puako Bay, T. H.).

Diagnosis based on holotype (USNM 50879).

3*b*. Dark blotch small, covering 2 or 3 vertical scale rows and 2 to 4 lengthwise scale rows, this dark blotch entirely below lateral line; white blotch behind pectoral usually present.

4*a*. Dark blotch opposite lateral line pores 7 to 9 and in front of tips of appressed pectorals; white spots, (red when alive) one on each scale, numbering from 1 to 14 along lateral line, usually only 4 or 5 at anterior part of lateral line, these spots may preserve as brownish; cheek scales in 8 to 11 rows; opercular scales usually 3; plate 96,A____________________**H. pentadactylus**[42] (Linneaus)

4*b*. Dark blotch below lateral line pores 9 to 11, located on middle of side, about 2 or 3 scale rows in diameter, and opposite tips of appressed pectoral fins; the scales forming the margin of dark blotch each have a white spot; cheek scales in 8 rows; opercular scales 2______________________**H. hypospilus**, new species

1*b*. Patch of scales below eye notably not reaching to opposite rear corner of mouth.

5*a*. A single row of scales below eye and sometimes with 1 or 2 more scales in a second row; dark dorsal blotch above lateral line, opposite lateral line pores 14 and 15, about 2 scales wide in diameter; side behind pectoral cream-colored (red when alive) blotch; sometimes 4 vertical bars are present, or they may be represented by dusky areas on sides or on back________**H. niveilatus**[43] (Jordan and Evermann)

5*b*. Patch of scales in 3 or more rows below eye but not reaching to corner of mouth.

6*a*. Dark dorsal blotch small, located above lateral line pores 14 or 15, about 2 scale widths in diameter; 4 vertical dark bars on upper sides usually present, often indistinct__**H. aneitensis** (Günther)

6*b*. Dark dorsal blotch, large, located behind head, below lateral line, opposite lateral line pores 2 to 9, covering 7 or 8 vertical scale rows and about 7 or 8 lengthwise rows; caudal peduncle with an oblong dark blotch on midside; between the two dark blotches sometimes a fainter dark area about 2 or 3 scales in diameter occurs opposite lateral line pore 15____**H. celebicus** (Bleeker)

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[41] *Hemipteronotus umbrilatus* Jenkins, Bull. U. S. Fish Comm., vol. 19 (1899), p. 53, fig. 10. 1900 (type locality, Hawaiian Islands).

[42] *Coryphaena pentadactylus* Linnaeus, Systema naturae, ed. 10, p. 261, 1758 (type locality, India).

Hemipteronotus quinque-maculatus Lacepède, Histoire naturelle des poissons, vol. 3, pp. 214, 215, 1802 (type localities, China, Moluccas, East Indies).

Xirichthys cyanirostus (Cuvier) Guerin-Meneville, Iconographie du règne animal . . ., poissons, vol. 3, p. 27, pl. 43, fig. 3, 1829–1838 (type locality, Pondicherry; ref. copied).

Novacula sex-maculata Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 14, p. 72, 1839 (type locality, Bombay).

Novacula punctulata Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 14, p. 73, (type locality, Bombay).

Novacula tessellata Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 14, p. 74 (type locality, Mauritius).

Philippine specimens totaling 83 were studied.

[43] *Xyrichthys niveilatus* Jordan and Evermann, Bull. U. S. Fish. Comm., vol. 22 (1903), p. 194, 1904 (type locality, Honolulu).

Holotype (USNM 50646), and other Hawaiian specimens were used as the basis of this diagnosis.

HEMIPTERONOTUS HYPOSPILUS, new species

FIGURE 97

Holotype.—Only known specimen (USNM 152989), Celebes, Makasser Market, December 22, 1909, *Albatross*, standard length 119 mm.

Description.—Dorsal rays IX,12; anal III,12; pectoral ii,10 and ii,10; branched caudal rays 6+6; pores in lateral line 20+5; vertical scale rows 26 or 27, with 2 scales above lateral line to base of first dorsal soft ray and 10 below to anal origin; gill rakers on first gill arch 5+1+8; cheek below eye with about 8 rows of scales, this patch of scales reaching to corner of mouth; upper part of opercle with 2 scales.

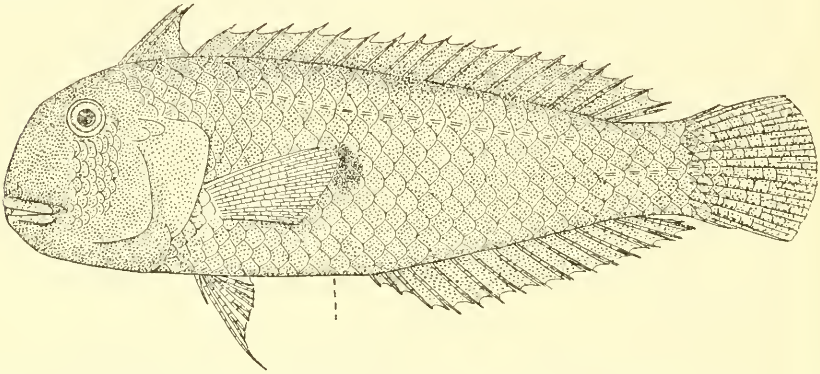

FIGURE 97.—*Hemipteronotus hypospilus*, new species, holotype, USNM 152989 from Makasser market, Celebes. Drawn by A. M. Awl.

Precision measurements were made on the holotype, and these are expressed in thousandths of the standard length, 119 mm. Length of head 303; greatest depth 319; least depth of caudal peduncle 130; length of caudal peduncle 101; snout 160; eye 83; fleshy interorbital space 71; postorbital length of head 143; distance between anterior and posterior nostrils 8; least suborbital distance to mouth 122; snout tip to anus 498; snout tip to dorsal origin 269; longest fin ray of pectoral 193, of pelvic 202, caudal 202, soft anal 109, and of soft dorsal 105; longest dorsal spine (first) 130, anal spine (third) 80.

Head 3.3; greatest depth 3.1; longest pectoral ray 5.1; snout tip to anus 2.1; snout to dorsal origin 1.3, all in the standard length. Snout 1.8; eye 5.5; postorbital length of head 2.1; fleshy interorbital space 6.0; longest pectoral ray 1.5; least depth of body 2.3; all in length of head. Eye in fleshy interorbital space 0.8.

Dorsal profile of snout forming an angle of 90 degrees with ventral contour of head; pectoral fin reaches to opposite tenth or eleventh lateral line pore; outer rays of pelvics elongate; distal margin of caudal fin a little rounded; first two spiny dorsal rays flexible (the next seven pungent) somewhat elongate, the membrane between dorsal spines II and III deeply incised; front of head and snout with fleshy keel.

Color in alcohol.—Background brownish, with a blackish spot on the third and fourth scale rows below lateral line, opposite lateral line pores 9 to 11, this spot about 2 or 3 scales in diameter, a white spot on each scale bordering edges of this spot; area in front of pectoral base white; a large white area behind pectoral base and beneath appressed pectoral fin, a black spot just above rear edge of whitish area. Other color marks faded.

Remarks.—This new species is distinguished from its closest relative, *H. pentadactylus* by the position of the dark spot, opposite lateral line pores 7 to 9 on the latter instead of 9 to 11; the dark spot on *hypospilus* is just above the rear border of the whitish area instead of over it as in *pentadactylus;* and the blackish spot is opposite the tips of the pectoral fin in *hypospilus* instead of just in front of pectoral fin tips, as in *pentadactylus*. Scales on cheek are more numerous in *pentadactylus* than in the new species. From other Indo-Pacific species referable to the genus *Hemipteronotus* the new species is distinguished in the key.

HEMIPTERONOTUS ANEITENSIS (Günther)

Plate 92, D

Novacula aneitensis Günther, Catalogue of the fishes in the British Museum, vol. 4, p. 176, 1862 (type locality, Aneiteum); Journ. Mus. Godeffroy, vol. 6 (Fische der Südsee, vol. 3, pt. 8), p. 285, pl. 147, fig. A, 1909.

Hemipteronotus liogenys Fowler, Journ. Acad. Nat. Sci., Philadelphia, vol. 12, p. 539, pl. 20, lower fig. 1904 (type locality, Padang, Sumatra).

SPECIMENS STUDIED

Bikini Atoll: Lagoon, July 29, 1946, Univ. Washington, 2 specimens, 154 to 159 mm.

Description.—Dorsal rays IX,12; anal III,12 in one, other spines are injured, but 12 soft rays are present; pectoral ii,10; branched caudal fin rays 5+5 or 5+6; pores in lateral line 22+5; scales above lateral line to base of first soft ray 2, and from lateral line to anal origin 11; gill rakers 6 or 7+1+11 or 12.

Head 3.0 to 3.1; greatest depth 2.6 to 2.7; longest pectoral ray 4.5 to 4.6; snout tip to anus 2.0; snout to dorsal origin 3.3 to 3.4; all in standard length. Snout 1.8 to 1.9; eye 5.5 to 5.9; postorbital length of head 1.8; interorbital space 4.6 to 6.0; longest pectoral ray 1.4 to 1.5; least depth of body 2.3; all in length of head. Eye in fleshy interorbital space 1.0 to 2.0.

Dorsal profile of snout forming an angle of 90 to 95 degrees with ventral contour of head; pectoral fin reaches to opposite about lateral line pore 12; outer rays of pelvics elongate, reaching to anus; distal margin of caudal fin a little rounded; first two spiny dorsal rays somewhat elongate, flexible, the membrane between second and third spines deeply incised but connecting basally with third spine; scales in area between pelvic and pectoral bases and anal origin about half the size of those on middle of sides; middorsal line of head and snout with fleshy keel.

Color in alcohol.—Background light brown, a prominent dark spot above lateral line and opposite lateral line pore 15; traces of about 5 vertical dark bars first near origin of dorsal, second below dorsal spine VI, third below dorsal soft rays 2 and 3, fourth below dorsal soft rays 8 and 9, and fifth at base of caudal fin.

HEMIPTERONOTUS CELEBICUS (Bleeker)

PLATE 92,B

Novacula celebica BLEEKER, Act. Soc. Sci. Indo-Néerl., vol. 1, p. 61, 1856 (type locality, Macassar); Atlas ichthyologique . . ., vol. 1, p. 153, pl. 30, fig. 5, 1862 (Celebes and Amboina).

SPECIMENS STUDIED

Bikini Atoll: Lagoon, July 29, 1946, Univ. Washington, 1 specimen, 114 mm.

Description.—Dorsal rays IX,12; anal III,12; pectoral ii,10–ii,11; branched caudal rays 5 + 5; pores in lateral line 20 + 6; scales above lateral line to base of first soft dorsal ray 2, and below to anal origin 10; gill rakers on first arch 6+1+12.

Head 3.1; greatest depth 2.5; longest pectoral ray 4.2; snout tip to anus 2.0; snout to dorsal origin 3.2; all in standard length. Snout 2.0; eye 5.0; postorbital length of head 2.0; interorbital space 4.5; longest pectoral ray 1.4; least depth of body 2.5; all in length of head; eye in fleshy interorbital space 1.2.

Dorsal profile of snout forming an angle of about 90 degrees with ventral contour of head; pectoral fin reaches to opposite lateral line pore 11; outer rays of pelvics elongate, reaching to anus; distal margin of caudal fin a little rounded; first two spiny dorsal rays flexible, a little elongate, the membrane between second and third spines deeply incised but connecting basally with third spine; scales in area between pelvic and pectoral bases and anal origin about ⅓ to ½ the size of those on middle of sides; middorsal line of head and snout with a fleshy keel.

Color in alcohol.—Background light brown; a large blackish blotch below lateral line pores 2 to 9 and just behind head on middle of side; this dark blotch covering 7 or 8 vertical and lengthwise scale rows; middle of caudal peduncle with a dark oblong blotch; a fainter dark area, 2 or 3 scales in diameter occurs on midside equidistant between the two other black areas and opposite lateral line pore 15.

Genus CHEILINUS Lacèpede

Cheilinus Lacepède, Histoire naturelle des poissons, vol. 3, p. 529, 1802 (type species, *Cheilinus trilobatus* Lacepède, designated by Bonaparte, Iconographia della fauna Italica . . ., vol. 3, Pesces, fasc. 30, 1841).

This genus may be recognized by the following characters: Dorsal rays IX or X, 8 to 10; anal III,8; pectoral rays ii,10, lateral line pores 14 to 16+6 to 9, totaling 20 to 22 vertical scale rows, with 2 scales above lateral line to base of first soft dorsal ray and 6 below to anal origin; branched caudal fin rays 6+5; gill rakers about 12 to 16; interorbital space convex; nostrils minute, anterior one a small tube; jaws equal or nearly so; teeth short, conical, uniserial; tips of both jaws with a pair of enlarged curved canines, upper jaw sometimes with 2 pairs of canines, those of lower jaw fit between those of upper jaw when mouth is closed; gill membranes broadly joined with a broad free fold across isthmus; head scaled except snout, preorbital space, and jaws; bases of median fins in a scaly sheath; lateral line interrupted; edge of preopercle free posteriorly about as much as ventrally.

KEY TO THE SPECIES OF CHEILINUS

1*a*. Dorsal rays X,9 rarely X or XI,8; small white specks or spots on sides; blackish spots and streaks on head and around eye.
C. chlorourus (Bloch)

1*b*. Dorsal rays IX,10 rarely X,9 (see table 98).
  2*a*. Head with distinct blackish or brownish streaks radiating from eye or crossing cheek (probably blue when alive).
    3*a*. On lower half of head 8 or 9 parallel black streaks extending at right angles to 3 or 4 white streaks in front of and behind eye (when alive, dark streaks are blue and white streaks are red).
C. digrammus (Lacepède)

    3*b*. Radiating forward from eye 2 nearly parallel black streaks, behind eye 2 more, a single one posterodorsally; each scale with a brownish vertical spot (in large adults spot becomes a line, vertical white lines (red when alive) occur on scales, and a large hump may develop on forehead)---------------------**C. undulatus** Rüppell

  2*b*. No dark streaks or lines on head as in 2*a*.
    4*a*. Background coloration pale, with 6 or 7 black bars, about 3 scales wide, on body and 2 black bars on caudal fin, white interspaces 2 scales wide ventrally, 1 wide dorsally (when alive, dark bands are blackish and pale interspaces are light red, with pale spots on fins and belly red); pale streaks (red when alive) radiating from eye-------------------------------**C. fasciatus** (Bloch)

    4*b*. Color pattern not as in 4*a*.
      5*a*. No bars on sides.
        6*a*. Dorsal surface of head with oblong white spots or short streaks; 3 or 4 white streaks radiate forward from eye on snout and 3 more posteriorly behind eye; about 3 white lines, narrower than others, extend from eye partly across cheek; scales on sides with broken reticulated dark lines and a more or less distinct lateral band, composed of more intensified

marks on scales, ending at caudal fin base as a small dark spot **C. celebicus** Bleeker

6*b*. Radiating fore and aft from eye a few pale streaks and, nearly at right angles below eye, white streaks that extend toward isthmus but not onto it; a pale streak, wider than others, may extend from eye across operculum to upper edge of pectoral fin base; no dark lines on scales as in 5*a*; a white or pale bar on caudal peduncle at rear of bases of dorsal and anal fins **C. rhodochrous** Günther

6*c*. No white spots or white streaks on head; 2 diverging dusky streaks may occur behind eye, upper lip with 2 or 3 blackish spots on each side of pale middle section; background coloration plain brownish, no white or dark edge on rear margin of caudal fin, but fin sometimes weakly barred; a dark spot between dorsal spines I to III and a small one at base of last dorsal ray **C. oxycephalus** Bleeker

5*b*. Background coloration brownish to light brownish, usually with 4 more or less distinct vertical brownish bars and an additional one on caudal fin; these dark bars separated by slightly narrower pale interspaces, except the last 2 pale bars are more distinct and usually wider than dark bar across caudal peduncle; caudal fin with broad pale margin on young and half grown (less distinct on large specimens); white spots and streaks on head (these begin to appear at a standard length of about 90 mm.); no dark spots or streaks behind eye.

C. trilobatus Lacepède

TABLE 98.—*Counts recorded for species of* Cheilinus.

Species	Fin rays										Pores in lateral line						
	Dorsal						Anal		Pectoral		Dorsal			Peduncular			
	IX	X	XI	8	9	10	III	8	ii	10	14	15	16	6	7	8	9
rhodochrous	7	----	----	----	----	7	7	7	19	19	----	7	----	----	3	4	----
diagrammus	3	----	----	----	----	3	3	3	6	6	1	2	----	----	1	2	----
fasciatus	7	----	----	----	----	7	7	7	10	10	3	3	----	----	----	3	3
trilobatus	58	----	----	----	----	58	4	4	3	3	----	1	5	----	5	----	1
chlorourus	----	44	1	3	42	----	6	6	6	6	1	4	----	----	4	1	----
oxycephalus	35	1	----	----	1	35	6	6	6	6	----	3	----	2	1	----	----
celebicus	3	----	----	----	----	3	3	3	3	3	1	1	----	----	2	----	----
undulalus	6	----	----	----	----	6	6	6	10	10	----	4	2	----	1	4	1

CHEILINUS CHLOROURUS (Bloch)

PLATE 96,C

Sparus chlorourus BLOCH, Naturgeschichte der ausländischen Fische, vol. 5, p. 24, pl. 260, 1791 (type locality, Japan).

SPECIMENS STUDIED

Bikini Atoll: 10 stations, 18 specimens, 14 to 96 mm. in standard length.
Eniwetok Atoll: 2 stations, 12 specimens, 7 to 150 mm.
Rongerik Atoll: 1 station, 2 specimens, 62 to 69 mm.
Rongelap Atoll: 7 stations, 24 specimens, 22 to 127 mm.
Likiep Atoll: 1 lot, Univ. Washington, 5 specimens, 46 to 55 mm.
Guam: 2 lots, 7 specimens, 25 to 112 mm.

Description.—Dorsal rays X,9, occasionally X or XI,8.

Head 2.4 to 2.7; greatest depth 2.4 to 2.8; longest pectoral ray 5.5 to 6.0; snout tip to anus 1.6 to 1.7; snout to dorsal origin 2.1 to 2.3; all in standard length. Snout 3.0 to 3.6; eye 3.6 to 5.7; postorbital length of head 1.9 to 2.1; interorbital space (bony) 4.2 to 5.3; longest pectoral fin ray 2.1 to 2.3; least depth of body 0.8 to 1.2; all in length of head. Distance between anterior and posterior nasal openings 4.0 to 6.5 in snout. Eye 0.9 to 1.6 in interorbital space.

Dorsal profile of head slightly concave in front of eyes on snout, forming 50 degree (young) to 75 degree (adults) angle with ventral contour of head; maxillary reaching to a vertical line through front of eye, or nearly so; pectoral fin reaches to opposite fifth or sixth scale of lateral line; first or second branched pectoral ray on pelvic reaches to anus on small specimens, becoming pointed and reaching past anal origin on adults; on the immature, caudal fin is rounded, whereas in adults the outer caudal rays may be elongate, causing caudal fin to have a concave rear margin.

Color in alcohol.—Background coloration light brown to brown; (on immature forms usually 4 vertical marbled brownish bars, first from dorsal origin through pectoral base, second from middle of spiny dorsal to a little behind pelvic base, third from front of soft dorsal to anal fin base, fourth on caudal peduncle); usually a brownish bar on middle of caudal fin; the base of the caudal fin has a characteristic and usually prominent broad white or pale bar, its width a little over ⅓ the length of middle caudal fin rays; other pale interspaces between vertical dark bars not prominent, sometimes nearly obsolete; pelvics dusky; usually a dusky blotch between first and third dorsal spines; lips usually barred; pectoral fin white; rear part of soft dorsal white; a small black spot occurs at bases of sixth to eighth soft dorsal fin rays; around the posteroventral part of the eye occur some characteristic black dots and streaks, one black, oblique, nearly straight, short line on posteroventral margin of eye, and separated from it dorsally by a narrow pale interspace at rear of eye is a small black spot or short black streak; scattered over the head are few to many small black dots or spots; the middle of the sides posteriorly may have the 3 or 4 characteristic brown spots found in other species of *Cheilinus;* (underside of head sometimes barred on immature forms). In specimens of from 100 to 150 mm. in standard length the body coloration is nearly plain brownish, the vertical bars are indistinct and the white caudal fin bar distinct or indistinct; the dark spots and streaks around the eye and on the head and body may or may not be distinct; traces of white specks are usually distinguishable on head and median fins, but are seldom visible on the body.

Color when alive.—Background coloration dark to light brown, the median fins reddish brown; brownish vertical bars distinct on small specimens; head, body, and median fins with pale bluish to white specks or tiny spots mostly arranged in rows, usually one row for each row of scales although there may be 2 or 3 white spots on some of the scales; a prominent white bar below eye meeting its fellow from other side on ventral part of head; 4 or 5 reddish brown streaks radiate from front half of eye, streak under the eye black with edges tinged reddish brown; rear part of soft dorsal pale pinkish; tips of membranes of spiny dorsal tinged with reddish.

Ecology.—This species was common in the tidal zone on the reefs, and was taken in the lagoon in water at a depth of 40 feet. It seemed to prefer the protection of coral heads.

Remarks.—*C. chlorourus* might be confused with *trilobatus*, were it not that it has one more dorsal spine and one fewer soft dorsal ray than the latter, i.e., X,9 instead of IX,10. *C. chlorourus* usually is covered with small white specks or spots whereas on the body of *trilobatus* these are lacking, being replaced with vertical red streaks on the scales and red spots or red streaks on the head. The black spots and streaks on head and around eye, characteristic of *chlorourus*, are lacking on *trilobatus*.

One of our kodachromes shows the pale spots to be light bluish instead of red as shown in various figures.

CHEILINUS DIGRAMMUS (Lacepède)

Plate 96,D

Labrus digramma Lacepède, Histoire naturelle des poissons, vol. 3, pp. 448, 518, 1802 (type locality, "Great Equatorial Ocean").

SPECIMENS STUDIED

Bikini Atoll: 2 stations, 3 specimens, 46 to 143 mm. in standard length.

Description.—Counts are recorded in table 98.

Head 2.4 to 2.5; greatest depth 2.9 to 3.1; longest pectoral ray 6.2 to 7.0; snout tip to anus 1.6; snout to dorsal origin 2.2 to 2.3; all in standard length. Snout 2.4 to 2.5; eye 5.0 to 5.2; postorbital length of head 2.1 to 2.2; interorbital space (bony) 6.0 to 7.0; longest pectoral fin ray 2.6 to 2.8; least depth of body 2.7 to 2.8; all in length of head. Distance between anterior and posterior nasal openings 7 to 8 in snout. Eye 1.1 to 1.2 in fleshy interorbital space.

Dorsal profile of head slightly convex, scarcely with a concavity over orbits, forming an angle of 45 to 50 degrees with ventral contour of head and body; interorbital space a little convex, becoming more so in adults; lower jaw slightly projecting when mouth is closed; maxillary reaching to a vertical line through rear nostril but not to eye; head mostly naked, sometimes with a few embedded scales on cheek and behind eye, dorsal side of head naked; body scaled, but scales along bases of dorsal and anal fins scarcely forming a sheath; pectoral fin reaches to opposite sixth lateral line scale; second branched pectoral ray longest; pelvics not quite reaching to anus; rear margins of median fins rounded, that of caudal fin truncate, outer rays of caudal fin of adults becoming elongate and projecting somewhat.

Color in alcohol.—Background coloration brownish dorsally, paler ventrally; dorsal surface of head with round or oblong white spots; 3 or 4 white streaks in front of eye and an equal number behind eye, these streaks parallel with each other, and a single white streak just below eye; on lower half of head and extending at right angles to the white streaks are 8 or 9 parallel black streaks, the first from corner of mouth to isthmus but none extend on isthmus; outer caudal rays dark brown, middle caudal rays pale; dorsal fin dusky except distal part of soft rays white; anal, pectoral, and pelvics pale.

Color when alive.—The dark streaks are blue, white streaks red; caudal fin greenish; paired fins yellowish.

Remarks.—This well-marked species was rare on the reefs and in the lagoon where we fished. It may prefer deeper water since 2 of our specimens were caught on hook and line at a depth of nearly 100 feet in Bikini lagoon.

CHEILINUS UNDULATUS Rüppell

PLATE 95,D

Cheilinus undulatus RÜPPELL, Neue Wirbelthiere zu der Fauna von Abysinnien gehörig; Fische, p. 20, pl. 6, fig. 2, 1835 (type locality, Djedda, Red Sea).

SPECIMENS STUDIED

Guam: Apra Bay, *Albatross* 1907, standard length 134 mm.

Description.—Counts are recorded in table 98. Head 2.5; greatest depth 2.7; longest pectoral ray 5.2; snout tip to anus 1.6; all in standard length. Snout 2.7; eye 5.0; postorbital length of head 2.1; interorbital space (bony) 4.8; longest pectoral ray 2.0; least depth of body 2.5; all in length of head. Eye 1.2 in interorbital space.

Dorsal profile of head slightly convex, forming an angle of 65 degrees with ventral contour of head; maxillary reaches almost to a vertical line through front of eye; pectoral fin reaches to opposite lateral-line pore 8.

Color in alcohol.—Background coloration light tan, each scale with a vertically elongate brown spot or streak, bordered posteriorly with a white streak; dorsal, anal, and caudal fins barred; radiating forward from eye across preorbital are 2 nearly parallel dark brownish streaks, 2 more behind lower half of eye and a shorter one from posterodorsal part of eye; head with some white lines, more or less interconnecting.

Color when alive.—White streaks are reddish and background coloration is generally greenish.

Remarks.—This species was not captured in the northern Marshall Islands but probably occurs there. In islands farther south it reaches an enormous size, probably a total length of at least 6 feet.

CHEILINUS FASCIATUS (Bloch)

Plate 91,A

Sparus fasciatus Bloch, Naturgeschichte der ausländischen Fische, vol. 5, p. 18, pl. 257, 1791 (type locality, Japan).

Cheilinus nigropinnatus Seale, Occ. Pap. Bishop Mus., vol. 1, No. 3, p. 86, 1901 (type locality, Marianas).

SPECIMENS STUDIED

Bikini Atoll: 4 stations, 9 specimens, 39 to 203 mm. in standard length.
Eniwetok Atoll: 1 station, 1 specimen, 82 mm.
Rongelap Atoll: 1 station, 1 specimen, 154 mm.

Description.—Counts are recorded in table 98.

Head 2.5 to 2.7; greatest depth 2.5 to 2.6; longest pectoral ray 2.0 to 2.1; snout tip to anus 1.6; snout to dorsal origin 2.3; all in standard length. Snout 2.2 to 2.6; eye 4.2 to 6.0; postorbital length of head 2.1; interorbital space (bony) 3.6 to 4.0; longest pectoral fin ray 2.0 to 2.1; least depth of body 2.4 to 2.5; all in length of head. Distance between anterior and posterior nasal openings 4.5 to 7.0 in snout. Eye 1.4 to 2.1 in interorbital space.

Dorsal profile of head arched but with a shallow concavity dorsal to or a little in front of eye, often forming an angle of about 65 to 70 degrees with ventral contour of head; interorbital space convex in young, strongly convex in adults; maxillary reaching to a vertical line through rear nostril but not to front of eye; first or second branched pectoral ray from dorsal edge longest; pelvics do not quite reach to anus, even in adults; rear margins of median fins rounded in young, but rays of soft dorsal and soft anal fins elongated, and upper and lower rays of caudal fin greatly elongated, in large adults.

Color in alcohol.—Background coloration white or pale with 6 or 7 black bars, about 3 scales wide, on body and 2 black bars on caudal fin, the white interspaces 2 scales wide ventrally and 1 dorsally, these black and white bars are curved on dorsal and anal fins, but usually do not quite extend to the distal edge; distal edges of dorsal and of anal fins in adults with a dusky band; all median fins of adults speckled with very small white spots, these white spots occurring on belly of adults; sometimes behind head on large adults are a few scattered black scales, and others anteriorly on body may be peppered with black specks; a black streak on base of pectoral fin; pectoral and pelvics white in adults, or pelvics have a dusky central portion; head may be white (in young) with two dark diverging black streaks behind eye, or blackish or brownish anteriorly (in adults) with rear half pale and 6 to 12 white streaks radiating from eye, these sometimes lacking dorsally; isthmus usually pale or white

Color when alive.—Dark bands blackish, interspaces light red, rear half of head red, front part dark brown; pectoral and pelvics red; pale spots on fins and on belly red; pale streaks radiating from eye red.

Remarks.—This species was rarely seen or taken, and probably preferred deeper waters than occurred in the intertidal zone. We note that Weber and De Beaufort referred *Wetmorella philippina* Fowler and Bean to the synonymy of *C. fasciatus*. We have a nice series of several species of *Wetmorella*, and can state definitely that this genus is distinct from *Cheilinus*.

CHEILINUS CELEBICUS Bleeker

PLATE 95,C

Cheilinus celebicus BLEEKER, Nat. Tijdschr. Nederl.-Indië, vol. 5, p. 171, 1853; Atlas ichthyologique . . . , p. 70, pl. 28, fig. 3, 1862 (type locality, Celebes; Sangi; Batjan; Obi-major; Amboina).

Cheilinus hoeveni BLEEKER, Atlas ichthyologique . . . , p. 70, pl. 27, fig. 1, 1862 (Amboina).

Cheilinus rostratus CARTIER, Verh. Ges. Würzburg, vol. 5, p. 103, 1873 (type locality, Cebu, Philippines).

SPECIMENS STUDIED

Bikini Atoll: lagoon, hook and line, March 11–31, S–46–2, Schultz, 1 specimen, 102 mm.; Arji Island, depth 20 to 40 feet in lagoon, August 7, 1946, S–46–308, 1 specimen 84 mm.

Description.—Counts are recorded in table 98.

The vertebral column on the 102 mm. specimen shows injury and regeneration so that the caudal peduncle is foreshortened, thus no proportional measurements were made involving the standard length. Snout 2.6; eye 5.5; postorbital length of head 2.1; interorbital space (bony) 5.9; longest pectoral fin ray 2.3; least depth of body 3.0; all in length of head. Distance between anterior and posterior nasal openings 7.5 in snout. Eye 1.2 in fleshy interorbital space.

Dorsal profile of head nearly straight, forming an angle of 43 degrees with ventral contour of head and body; interorbital space a little convex; lower jaw a little projecting; maxillary reaching to a vertical line through rear nostril but not quite to eye; 2 rows of scales on cheek; second or third pectoral ray longest; caudal rounded.

Color in alcohol.—Background coloration pale olive to light brownish dorsally, with more or less broken reticulated dark lines on scales, and a more or less distinct lateral band composed of more intensified marks on the scales, ending in a small dark spot at base of caudal fin; dusky from behind eye to opercular flap; dorsal surface of head with oblong white spots or short streaks; 3 or 4 white streaks radiating forward from eye on snout and 3 more radiating from posterior side of eye; about 3 white lines, notably narrower than others around eye, extending from eye partly across cheek; rays of median fins green, membranes hyaline; middle of pelvic fins dusky or blackish; pectoral hyaline.

CHEILINUS RHODOCHROUS Günther

PLATE 91,B

Cheilinus rhodochrous GÜNTHER, *in* Playfair and Günther, the fishes of Zanzibar, p. 90, pl. 9, fig. 3, 1866 (type locality, Zanzibar).

Cheilinus unifasciatus STREETS, U. S. Nat. Mus., Bull. 7, p. 82, 1877 (type locality, Fanning Islands; types USNM 19223, 19224).

SPECIMENS STUDIED

Bikini Atoll: 6 stations, 13 specimens, 73 to 168 mm. in standard length.
Rongerik Atoll: 1 station, 1 specimen, 70 mm.
Rongelap Atoll: 2 stations, 2 specimens, 86 and 89 mm.
Rota Island: 1 lot, 2 specimens, 195 and 225 mm.

Description.—Counts are recorded in table 98.

Head 2.4 to 2.5; greatest depth 2.7 to 3.0; longest pectoral ray 6.0 to 6.8; snout tip to anus 1.6; snout to dorsal origin 2.3; all in standard length. Snout 2.3 to 2.8; eye 4.5 to 6.7; postorbital length of head 2.0 to 2.1; interorbital space (bony) 4.8 to 7.0; longest pectoral fin ray 2.5 to 2.8; least depth of body 2.7 to 3.1; all in length of head. Distance between anterior and posterior nasal openings 7 to 11 in snout; eye 0.9 to 2.0 in fleshy interorbital space.

Dorsal profile of head slightly convex, without any concave area at interorbital space, forming an angle of 40 to 50 degrees with ventral contour of head and body; lower jaw slightly projecting, when mouth is closed; maxillary reaching to a vertical line through rear nasal opening but not quite to eye; head except cheek and operculum naked and dorsal side scaled forward nearly to interorbital space; body scaled, but scales along bases of dorsal and anal fins scarcely forming a sheath; pectoral fin reaches to opposite sixth or seventh lateral line scale; first or second branched pectoral ray longest; pelvics not reaching to anus; caudal fin rounded, outer rays scarcely elongated even in longest specimens.

Color in alcohol.—Background coloration brownish, with a transverse white or pale bar across caudal peduncle at rear of bases of both dorsal and anal fins, this white bar one scale wide; radiating fore and aft from eye are a few white or grayish white streaks, and nearly at right angles below eye are white streaks that extend toward the isthmus but not on it (in our specimens); sometimes a pale streak a little wider than the others extends from the eye across operculum to upper edge of pectoral fin base; young may have lengthwise pale and darker streaks more or less evident, and some specimens the center of each scale, except those in white transverse bar, may be brownish; pectoral white; caudal and pelvics dusky, with outer rays of caudal sometimes darker than central part of fin.

Remarks.—Although we are following Weber and de Beaufort (Fishes of the Indo-Australian Archipelago, vol. 8, p. 90, 1940) in their synonymizing *Cheilinus unifasciatus* Streets with *C. rhodochrous* Günther, we are not fully convinced that the two are the same species, since in the original description of *rhodochrous* we find the statement, "several blue lines across throat, from the lower series of cheek scales on one side to that of the other." None of our specimens shows any such markings. Blue lines as described are found in *C. digrammus.*

CHEILINUS OXYCEPHALUS Bleeker

Plate 96,B

Cheilinus oxycephalus Bleeker, Nat. Tijdschr. Nederl.-Indië, vol. 5, p. 349, 1853 (type locality, Amboina); Atlas ichthyologique . . ., vol. 1, p. 65, pl. 28. fig. 5, 1862 (Batu, Flores, Batjan, Amboina).

SPECIMENS STUDIED

Bikini Atoll: 10 stations, 25 specimens, 33 to 106 mm. in standard length.
Rongelap Atoll: 6 stations, 12 specimens, 47 to 80 mm.
Likiep Atoll: Univ. Washington, 4 specimens, 64 to 90 mm.

Description.—Counts are recorded in table 98.

Head, 2.4 to 2.5; greatest depth 2.5 to 3.0; longest pectoral ray 5.9 to 6.0; snout tip to anus 1.5 to 1.6; snout to dorsal origin 2.3; all in standard length. Snout 3.0 to 3.2; eye 4.0 to 5.2; postorbital length of head 2.0 to 2.1; interorbital space 5.1 to 6.0; longest pectoral fin ray 2.2 to 2.7; least depth of body 2.1 to 2.4; all in length of head. Distance between anterior and posterior nasal openings 4.5 to 7.0 in snout. Eye 1.0 to 1.5 in interorbital space.

Dorsal profile slightly concave over eye to nearly straight, forming an angle of 50 to 55 degrees with ventral contour of head; maxillary reaching to a vertical line through rear nostril, usually not quite to eye; maxillary covered by preorbital; pectoral fin reaches to opposite sixth lateral line scale; first or second branched pectoral ray longest; pelvics reach about ⅔ to ⅘ the way to the anus; caudal fin rounded.

Color in alcohol.—Background coloration mostly plain brownish without vertical bars; caudal fin plain brownish, no white or dark edge on rear margin of caudal fin but fin sometimes weakly barred; a small dark spot at base of next to last dorsal ray; no white spots or white streaks on head; sometimes two diverging dusky streaks behind eye; upper lip with 2 or 3 blackish spots on each side of pale middle section; black blotch between first to third dorsal spine; no pale bars on caudal peduncle or on base of caudal fin; pelvics dusky; pectoral pale; rear part of soft dorsal fin pale or white; usually 3 or 4 dark spots on body along midlengthwise axis but sometimes lacking, more prominent in the small specimens, first about opposite tips of pectorals, second over front part of soft anal base, third opposite rear base of dorsal, and fourth át base of caudal fin.

Color when alive.—Plain brownish or greenish brown.

Ecology.—This species was common in the tidal zone of the reefs, especially where coral and algal growths were abundant.

Remarks.—*C. oxycephalus* is characterized by its plain brownish color, having no pale bars on caudal peduncle or on base of caudal fin; behind the eye on the young are 2 diverging faint brownish streaks which are not found on the largest specimens; these streaks are not exactly in the same position as the dark streaks around the eye of *C. chlorourus.*

CHEILINUS TRILOBATUS Lacepède

PLATE 95,A,B

Cheilinus trilobatus LACEPÈDE, Histoire naturelle des poissons, vol. 3, pp. 529, 537, pl. 3, fig. 3, 1802 (type locality, Reunion, Mauritius, Madagascar).

SPECIMENS STUDIED

Bikini Atoll: 16 stations, 61 specimens, 22 to 193 mm. in standard length.
Eniwetok Atoll: 3 stations, 7 specimens, 27 to 127 mm.
Rongelap Atoll: 8 stations, 30 specimens, 17 to 182 mm.
Rongerik Atoll: 3 stations, 9 specimens, 48 to 73 mm.
Kwajalein Atoll: 1 station, 1 specimen, 16 mm.
Likiep Atoll: 1 lot, Univ. Washington, 10 specimens, 33 to 131 mm.
Guam: 3 lots, 11 specimens, 35 to 210 mm.

Description.—Counts are recorded in table 98.

Head 2.4 to 2.5; greatest depth 2.3 to 2.6; longest pectoral ray 5.0 to 5.7; snout tip to anus 1.6; snout to dorsal origin 2.1 to 2.3; all in standard length. Snout 2.7 to 3.5; eye 4.0 to 6.8; postorbital length of head 1.9 to 2.0, interorbital space (bony) 4.1 to 5.5; longest pectoral fin ray 2.1 to 2.3; least depth of body 2.2 to 2.5; all in length of head. Distance between anterior and posterior nasal openings 4 to 8 in snout. Eye 0.9 to 1.6 in interorbital space.

Body somewhat compressed; snout normal, not elongated or tubular; dorsal profile of head straight or slightly concave, forming an angle of 60 to 70 degrees with ventral contour of head; maxillary reaching to a vertical line through front of eye or rear nasal opening; maxillary covered by preorbital; pectoral fin reaches to opposite seventh lateral line scale; usually second branched pectoral ray from dorsal edge longest; pelvics reach to anus on small specimens and far back of anus on large adults; on large adults the soft rays of dorsal and anal fins are greatly elongate, reaching past base of caudal fin; in the immature the caudal fin is rounded, whereas in large adults the outer rays are elongate and the rear margin of the fin is trilobate.

Color in alcohol.—Background coloration brownish to light brownish, usually with 4 more or less distinct vertical brownish bars and an additional one on caudal fin; these dark brownish bars separated by pale interspaces a little narrower than the dark bars, except that last two pale bars are more distinct and are usually wider than the dark bar across caudal peduncle; caudal fin with broad pale margin posteriorly on young and half grown but less distinct on large specimens, usually 3 or 4 small dark spots occur along middle of sides, last one at midbase of caudal fin, usually in the pale vertical bar; at about a standard length of 90 mm., white spots and streaks on the head begin to appear; these have a somewhat definite pattern, especially around eye and on snout as shown in the plate; a small dark spot occurs at bases of seventh to eighth soft dorsal rays; lips of young dusky, not barred, but lips of adults may have small pale spots; there are no distinct narrow blackish streaks or black spots below and behind eye; specimens about 190 mm. have the edges of the scales brown and centers pale so that it gives the appearance of pale lengthwise streaks alternating with wavy lines.

Color when alive.—Background coloration purplish brown or pale olive, with the vertical dark bars purplish to rusty brown; dorsal fin yellowish to orange-yellow; rear of caudal fin broadly margined with reddish yellow; membrane between caudal rays posteriorly bright red; anal fin orange to yellowish, with two red streaks distally but not distinct on small specimens; anterior edge of pelvics orange; head with bright red spots and red streaks; each scale of body, except those posterioventrally, with a single vertical red line; all these red marks are pale or white in alcoholic specimens; pelvic fins yellowish or reddish.

Ecology.—This is an abundant species both in the shallow reef waters and in the deeper waters of the lagoon, especially around luxuriant growths of algae and corals.

Remarks.—*C. trilobatus* is closely related to *C. chlorourus* in coloration but may be distinguished in having IX,10 dorsal rays instead of X,9 in *C. chlorourus*; the latter also has below the eye and on the head dark streaks and spots that are lacking in *C. trilobatus*.

Genus **PSEUDOCHEILINUS** Bleeker

Pseudocheilinus Bleeker, Proc. Zool. Soc. London, p. 409, 1861 (type species, *Cheilinus hexataenia* Bleeker).

Current authors (Fowler and Bean, U. S. Nat. Mus. Bull. 100, vol. 7, p. 341, 1928; Weber and de Beaufort, Fishes of the Indo-Australian

Archipelago, vol. 8, p. 96, 1940) have recognized only one species in this genus. However, my studies of the numerous specimens in the U. S. National Museum indicate at least 4 well defined species, as distinguished in the accompanying key. The statements that the "color varieties" are variations of a single species are not correct. I find that the basic color pattern of each species is scarcely variable and much confidence can be placed in it. The pectoral fin rays are rather constant for each species but differ from 11 to 15, so that certain species may be identified on the basis of the number of pectoral rays along with color pattern.

This genus may be recognized by the following characters: Branched caudal fin rays 6+5; gill rakers about 4 to 7+1+7 to 9; lateral line pores 14 to 18+5 to 7, with 2 scales above lateral line to base of first soft dorsal ray and 6 or 7 scales below to anal origin; usually about 19 to 25 vertical scale rows; dorsal rays normally IX,11 and anal III,9; pectoral rays ii,11 to 15; 2 or 3 rows of scales below eye on cheek, and 1 row on interoperculum; a row of elongate scales on basal part of dorsal and anal fins; opercle scaled; dorsal surface of head naked; pupil in two parts; nostrils minute, anterior one a short tube; jaws equal, upper jaw with 2 or 3 pairs of small caninelike teeth at symphysis, on each side of which is an enlarged canine hooked outward and posteriorly; symphysis of lower jaw with a pair of enlarged canines; both jaws anteriorly with a few small conical teeth in 2 or 3 rows, becoming uniserial on sides; gill membrane free from isthmus, with a broad fold across it; posterior edge of preopercle free posteriorly as much as ventrally; caudal fin rounded.

This genus resembles *Pseudocheilinops* but the two may be distinguished by the key on pages 121–123.

KEY TO THE SPECIES OF PSEUDOCHEILINUS

1*a*. Body with 3 to 9 lengthwise dark streaks alternating with lighter streaks.

  2*a*. Upper edge of caudal peduncle at base of caudal fin with a black spot a little smaller in size than pupil; in addition to the median dorsal dark streak in front of dorsal fin, there are 6 more on the upper side of the body, ventralmost dark streak extends from the dorsal edge of pectoral base to caudal peduncle, where it occurs on the scale row below lateral line; chin with a pair of dark spots; upper lip usually barred; dorsal surface of head with about 7 alternating dark and light streaks; pectoral fin rays ii,13 or 14 (see table 92, on page 129).
  P. hexataenia (Bleeker)

  2*b*. No black spot on caudal peduncle at base of caudal fin; dorsal surface of head with 5 alternating dark and light streaks.

    3*a*. Side of body with 7 to 9 alternating dark and light streaks; pectoral rays ii,12 rarely ii,11 or ii,13__________________**P. octotaenia** Jenkins

    3*b*. Side of body with 3 alternating dark and light lengthwise streaks, on upper half of body, the center of each dark streak paler than edges; pectoral fin rays ii,14 rarely ii,15.
    P. tetrataenia, new species

1b. Body without alternating dark and light streaks; pelvic fins without a black spot; pectoral fin rays ii,12........**P. evanidus**[44] Jordan and Evermann

PSEUDOCHEILINUS HEXATAENIA (Bleeker)

PLATE 99,B

Cheilinus hexataenia BLEEKER, Act. Soc. Sci. Indo.-Néerl., vol. 2, p. 4, 1857 (type locality, Amboina).

Pseudocheilinus hexataenia BLEEKER, Atlas ichthyologique . . . vol. 1, p. 73, pl. 23, fig. 2, 1862 (Amboina, Goram).—FOWLER and BEAN, U. S. Nat. Mus. Bull. 100, vol. 7, p. 341, 1928 (Philippine specimens only, 21968; 1975, and the one from Galera Island).

Pseudocheilinus psittaculus KNER and STEINDACHNER, Stizb. Akad. Wiss. Wien, vol. 54, p. 376, fig. 7, 1866 (type locality, McKean Island, Phoenix Islands).

Cossyphus echis GUICHENOT, Nouv. Arch. Mus. Hist. Nat., Paris, vol. 5, p. 197, pl. 12, fig. 5, 1869 (type locality, Madagascar).

SPECIMENS STUDIED

Bikini Atoll: 5 stations, 10 specimens, 28 to 39 mm.
Eniwetok Atoll: 1 station, 1 specimen, 20 mm.
Rongelap Atoll: 5 stations, 15 specimens, 23 to 46 mm.
Likiep Atoll: 1 lot, Univ. Washington, 1 specimen, 37 mm.

Description.—Various counts are recorded in table 92 (p. 129).

Head 2.5 to 2.7; greatest depth 2.5 to 2.7; longest pectoral ray 4.8 to 4.9; snout tip to anus 1.5 to 1.6; snout tip to dorsal origin 2.3 to 2.4; all in standard length. Eye 2.9 to 3.6; postorbital length of head 2.1 to 2.3; fleshy interorbital space 4.0 to 4.2; longest pectoral ray 1.7 to 2.0; least depth of body 2.0 to 2.1; all in length of head. Eye in fleshy interorbital space 0.7 to 0.9.

Dorsal profile of head forming an angle of 50 to 60 degrees with ventral contour of head; pectoral fin reaches to opposite lateral line pore 9; first soft ray of pelvics longest; distal margin of caudal fin rounded; all the spiny dorsal rays pungent; second anal spine longer and stronger than third; extending from tip of anal spines I and II on adult males is a long fleshy filament.

Color in alcohol.—Background coloration light greenish; a black spot near dorsal edge of caudal peduncle at base of caudal fin; a median dorsal brownish streak in front of dorsal fin and six more brown streaks on upper side, following each scale row, the fifth is usually fainter than the others; dorsal surface of head, posteriorly, with 7 or 8 alternating light and dark streaks; basal area of fins bluish green.

Color when alive.—The following description was recorded for *Albatross* silk tag No. 1975, Philippines: "Alternate blue and orange stripes from behind eye to base of caudal; two last beginning behind head; lower side of head pink, belly similar, breast with blue shade. Blue and orange stripes continued on dorsal, terminal portion somewhat orange; soft fin hyaline. Caudal emerald, small black speck in upper base. Anal with terminal portion of membrane pale reddish and its base blue. Ventrals blue. Pectorals hyaline."

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[44] *Pseudocheilinus evanidus* Jordan and Evermann, Bull. U. S. Fish. Comm., vol. 22 (1902), p. 192, 1903 (type locality, Hilo, Hawaii).

Pseudocheilinus evanidus Fowler and Bean, U. S. Nat. Mus. Bull. 100, vol. 7, p. 341, 1928 (Philippine specimen, with linen tag No. 2017.)

Ecology.—This small-sized species reaches maturity at a length of 40 mm. and smaller. It is a common inhabitant of the intertidal zone on the reefs and of depths to at least 40 feet in the lagoon.

PSEUDOCHEILINUS OCTOTAENIA Jenkins

PLATE 99, C

Pseudocheilinus octotaenia JENKINS, Bull. U. S. Fish. Comm. vol. 19 (1899), p. 64, fig. 22, 1900 (type locality, Hawaiian Islands).

Pseudocheilinus margaretae SMITH, Ann. Mag. Nat. Hist., ser. 12, vol. 8, p. 928, fig. 1, 1955 (type locality, Aldabra, Indian Ocean).

SPECIMEN STUDIED

Bikini Atoll, Arji Island, lagoon, depth 20 to 40 feet, August 7, 1946, S–46–308, Herald and Brock, 1 specimen, 76 mm.

Description.—Dorsal rays IX,11; anal III,9; pectoral ii,12-ii,11; pores in lateral line 17+6, with 2 scales above and 7 below to anal origin; gill rakers in two Johnston Island specimens are 4+1+7 or 8. See table 92 (p. 129) for additional counts.

Head 2.6; greatest depth 3.0; longest pectoral ray 5.2; snout tip to anus 1.7; snout tip to dorsal origin 2.3; all in standard length. Snout 2.6; eye 4.6; postorbital length of head 2.1; fleshy interorbital space 5.7; longest pectoral ray 2.0; least depth of caudal peduncle 2.2; all in length of head. Eye in fleshy interorbital space 0.8.

Dorsal profile of snout forming an angle of about 55 degrees with ventral contour of head; pectoral fin reaches to opposite lateral line pores 8 or 9; first soft ray of pelvics longest; distal margin of caudal fin rounded; all spiny dorsal rays pungent, without elongate filaments; second and third anal spines strong and heavy, of about same length.

Color in alcohol.—Background light tan or light brownish; a median dark streak in front of dorsal fin and 7 brown lines or streaks on side of Bikini Atoll specimen, and 8 or 9 dark streaks in Johnston Island and Hawaiian Islands specimens; ventralmost of these streaks on the Bikini specimens begins in axil of pectoral, whereas in Johnston Island and Hawaiian material it begins on the second scale row below pectoral fin base; anterior edge of fleshy orbit black lined; dorsal surface of head with about 5 dark lines.

Ecology.—This species appears to be uncommon and was never seen by us in the intertidal zone in the northern Marshall Islands, but at Johnston Island it occurred in pools among luxuriant growths of corals and algae at a depth of 5 to 10 feet.

Remarks.—The single specimen from Bikini is not as darkly colored as those from Johnston and the Hawaiian Islands and this may account for the apparent absence of the two most ventrally located dark lines, which are fainter than the others.

J. L. B. Smith described as new *P. margaretae* from Aldabra. It appears, however, to be the same species as *P. octotaenia* Jenkins, for I have examined several lots that include numerous specimens of *P. octotaenia* and find only one possible difference between the two. In the drawing of *margaretae* the size of the 3 rows of scales on the cheek is smaller than that of those on the specimens of *octotaenia* before me. The drawing may be in error.

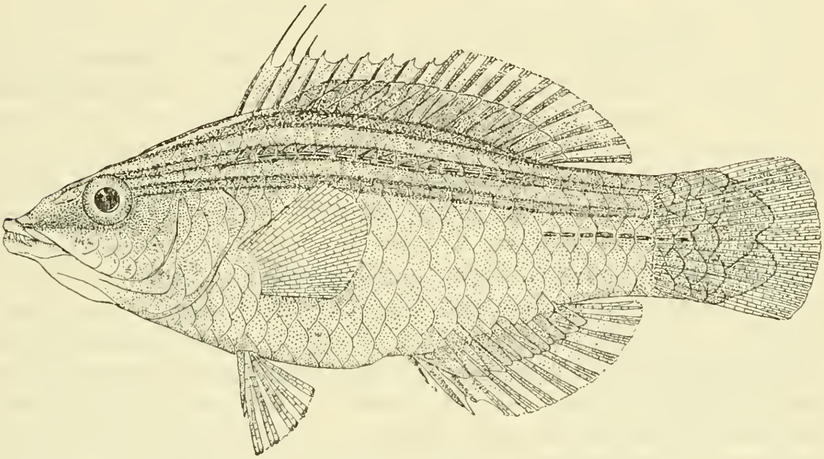

FIGURE 98.—*Pseudocheilinus tetrataenia*, new species, holotype, USNM 113596, from Bikini Atoll. Drawn by A. M. Awl.

PSEUDOCHEILINUS TETRATAENIA, new species

FIGURE 98

Holotype.—USNM 113596, Bikini Atoll, Reer Island, lagoon reef, August 12, 1946, S-46-332, Herald and Brock, standard length, 51 mm.

Paratypes.—Bikini Atoll: Erik Island, west end, ocean reef, March 19, 1946, S-46-9, Schultz and Brock, 3 specimens, 27 to 40 mm.; Bikini Island, ocean reef, March 22, 1946, S-46-15, Schultz and Brock, 3 specimens, 12 to 20 mm.; Lagoon coral heads, eastern end, depth 20 to 25 feet, March 26, 1946, S-46-42, Brock and Schultz, 2 specimens, 27 to 43 mm.; Romuk Island, ocean reef, April 1, 1946, S-46-47, Schultz, 2 specimens, 27 and 33 mm.; Boro Island, April 6, 1946, S-46-52, Schultz and Brock, 2 specimens, 36 to 45 mm.; Cherry Island, ocean reef, April 18, 1946, S-46-98, Schultz, 4 specimens, 25 to 41 mm.; Yuro Island, ocean reef, July 31, 1946, S-46-251, Herald, 9 specimens, 23 to 41 mm.; Off Amen Island, lagoon, depth 30 feet, August 4, 1946, S-46-307, Herald and Brock, 1 specimen, 35 mm.; Arji Island, lagoon, depth 20 to 40 feet, August 7, 1946, S-46-308, Herald and Brock, 2 specimens, 32 to 41 mm.; Boby Island, ocean reef, August 17, 1946, S-46-383, Herald, 6 specimens, 39 to 41 mm.; Eman Island, channel reef, July 17, 1947, S-46-405, Schultz, Brock and Myers, 6 specimens, 24 to 47 mm.; Amen Island, lagoon reef, July 21, 1947, S-46-442, Brock, Hiatt and Schultz, 6 specimens, 15 to 41 mm.; Namu Island, lagoon reef, August 6, 1947, S-46-508, Schultz, Brock and Hiatt, 1 specimen, 22 mm.; Bikini Island, ocean reef, August 16, 1947, S-42-565, Bayer, 1 specimen, 29 mm.; Enyu Island, August 19, 1947, Univ. Wash., 1 specimen, 31 mm. Eniwetok Atoll: USNM 163223, Bogan Island, 1952, H. S. Ladd, 1 specimen 20.5 mm.; Rongerik Atoll: Latoback Island lagoon reef, August 14, 1947, S-1041, Brock, Schultz, and Donaldson, 1 specimen, 44 mm. Rongelap Atoll: Millu Island, lagoon reef, June 19, 1946, S-46-220, Schultz and Herald, 10 specimens, 31 to 47 mm.; Kabelle Island, lagoon reef, June 20, 1946, S-46-231, Schultz and Herald, 1 specimen, 30 mm.; Kieshiechi Island, lagoon depth 20 feet, July 24, 1946, S-46-285, Brock and Herald, 2 specimens, 27 to 32 mm.; Tufa Island, depth 28 feet; July 29, 1946, S-46-300, Brock and Herald, 1 specimen, 32 mm.; Naen Island, west side, July 30, 1946, S-46-302, Herald, 2 specimens, 25 mm.; Yugui Island, ocean reef at channel, July 31, 1946, S-46-304, Herald, 14 specimens, 27 to 43 mm.; Lomuilal Island, lagoon reef, August 1, 1946, S-46-306, Herald, 3 specimens, 31 to 36 mm. Likiep Atoll: Likiep Island, August 22, 1949, Univ. Wash., 1 specimen, 37 mm. Arno Atoll: Eonebje Island, July 3, 1950, Strassburg and Hiatt, 2 specimens, 31 and 45 mm. Hawaii; USNM 164420, Kona Coast, Kealakekua, February 9-10, 1952, Gosline and Randall.

Description.—Counts made on the holotype and paratypes are recorded in table 92 (p. 129).

Precision measurements were made on the holotype and one paratype and these data are expressed in thousandths of the standard length respectively. Standard length 51 and 25.5 mm. Length of head 365 and 400; greatest depth 392 and 314; least depth of caudal peduncle 180 and 176; length of snout 127 and 122; diameter of eye 82 and 98; fleshy interorbital space 82 and 90; postorbital length of head 173 and 184; distance between anterior and posterior nostril 14 and 16; preorbital distance 55 and 43; length of caudal peduncle 161 and 184; snout tip to anus 628 and 576; snout tip to dorsal origin

392 and 435. Longest fin ray of pectoral 176 and 204, of pelvic 171 and —; longest dorsal spine (first) including filament 225 and 122; bony part of anal spine 118 and 129; longest ray of caudal 241 and 243; soft dorsal 151 and 153, soft anal 143 and 137.

Head 2.7 to 2.9; greatest depth 2.5 to 3.0; longest pectoral ray 5.0 to 5.3; snout tip to anus 1.7; snout tip to dorsal origin 2.3 to 2.6; all in standard length. Snout 2.9 to 3.0; eye 3.8 to 4.4; postorbital length of head 2.1 to 2.2; fleshy interorbital space 4.0 to 5.0; longest pectoral ray 1.9 to 2.0; least depth of caudal peduncle 1.8 to 2.3; all in length of head. Eye in fleshy interorbital space 0.6 to 1.0.

Dorsal profile of snout forming an angle of 60 to 67 degrees with ventral contour of head; pectoral fin reaches to opposite lateral line pore 8; first soft ray of pelvic longest; distal margin of caudal fin rounded; all spiny dorsal rays pungent, the first two with long fleshy filaments on adult males, whereas those on adult females are shorter; on adult mature males shorter filaments may occur on the third and fourth dorsal spines; anal spines without or with a very short filament on second spine; second anal spine stronger and a little longer than second.

Color in alcohol.—Background greenish; a median dorsal brown streak in front of dorsal fin, then a short one each side from above eye to opposite dorsal origin, then 3 brown streaks on upper side of body, the ventral most extending from eye through upper edge of gill opening to caudal fin base along scale row above peduncular lateral line; all brown streaks have pale centers; dorsal surface of head with 3 short brownish streaks; under side of head pale; basal part of all fins blue-green; belly brownish, with a greenish band extending from base of pectoral posteroventrally to region of anus.

Ecology.—This new species occurred abundantly in the intertidal zone of the reefs among coral heads and algal growths, and at depths down to at least 40 feet.

Remarks.—The specimen from Hawaii indicates a wide range in the Indo-Pacific for this new species. It may be distinguished from its closest relative, *P. hexataenia* by the occurrence of only 3 brown streaks on the upper side and no dark spot at base of caudal fin, whereas in *hexataenia* there are 6 dark streaks on the sides and a black caudal spot. In addition *tetrataenia* normally has ii,14 pectoral rays, whereas in *hexataenia* ii,13 and ii,14 pectoral rays occur in almost equal numbers (see table 92). *P. tetrataenia* may be distinguished from the other species in the genus by the key (p. 164).

Named *tetrataenia* in reference to the 4 dark streaks.

KEY TO THE GENERA OF THE LABRICHTHYIFORM FISHES

1*a*. Anal spines III, the first normally developed.

  2*a*. Posterior edge of preopercle not free, head fully scaled except front of snout, area in front of eye, and underside of mouth; both lips broad, fleshy, plicate externally and internally; lips without lobes; two pairs of canines in upper jaw, a single pair of enlarged canines on lower jaw, fitting between middle pair of upper jaw when mouth is closed------------------------------------**Labrichthys** Bleeker

  2*b*. Preopercle with a free posterior edge; head scaled behind and a little below eye, otherwise naked; lower lip at each corner with a forward projecting fleshy lobe; the pair of canines in upper jaw fits between the widely spaced and enlarged pair of canines at front of lower jaw when mouth is closed------------------------**Labroides** Bleeker

1*b*. Anal spines II, the typical first spine represented by a deeply embedded small knob in front of base of homologous second spine of other genera; both lips broad, fleshy, plicate; head scaled behind eye and a little below it, otherwise naked; a single pair of greatly enlarged canines in upper jaw fits between a smaller pair near tip of lower jaw when mouth is closed. **Diproctacanthus**[45] Bleeker

Genus LABRICHTHYS Bleeker

Labrichthys Bleeker, Nat. Tijdschr. Nederl.-Indië, vol. 6, p. 331, 1854 (type species, *Labrichthys cyanotaenia* Bleeker).

This genus may be recognized by the following characters: Branched caudal fin rays 6+6; gill rakers minute, probably about a dozen on first arch; pores in lateral line 25 to 27 to base of caudal fin, with 3 or 4 scales above lateral line and 10 or 11 below it; dorsal rays IX,11; anal III,11; pectoral ii,11 to 13, usually ii,12; body compressed, upper and lower lips fleshy, broad and thick, plicate internally and externally, more or less forming a "tube" when mouth is closed; dorsal profile of head convex, interorbital space convex; nostrils minute, anterior pair with raised rims, a little tubular; jaws of equal length; two pairs of canines in upper jaw, a pair near symphysis and another pair more laterally located; the single pair of enlarged canines in lower jaw are close together and fit between the middle pair of upper jaw when mouth is closed; a few small conical teeth in a single row at front of lower jaw on each side and an enlarged lateral canine tooth in front of corner of mouth of upper jaw; no free edge to preopercle, entire side of the head scaled, as is interorbital region to a little in front of a line connecting anterior nostrils; tip of snout preorbital, and underside of mouth naked; bases of all fins scaled.

The genus *Labrichthys* has been confused with the genus *Pseudolabrus.* Fowler (Mem. Bishop Mus., vol. 10, p. 356) refers *L. fuentesi* Regan to the synonymy of *Pseudolabrus inscriptus* (Richardson).

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[45] *Diproctacanthus* Bleeker, Proc. Zool. Soc. London, p. 415, 1861 (type species, *Labroides xanthurus* Bleeker).

Labropsis Schmidt, Trans. Pacific Comm. Acad. Sci. U. S. S. R., vol. 1, p. 76, figs. 3, 4, 1930, (type species, *Labropsis manabei* Schmidt).

Rendahl (Natural History of Juan Fernandez and Easter Island, vol. 3, Zool., pt. 1, art. 10, p. 65, 1921) described *L. semifasciatus* from Easter Island, but with XI dorsal spines and 4 canine teeth in the lower jaw, it could not belong to labrichthyiform fishes.

LABRICHTHYS CYANOTAENIA Bleeker

PLATE 97,F

Labrichthys cyanotaenia Bleeker, Nat. Tijdschr. Nederl.-Indië, vol. 6, p. 331, 1854 (type locality, Larantuka, Flores); Atlas ichthyologique, vol. 1, p. 154, pl. 22, fig. 1, 1862 (Flores).

Cossyphus unilineatus GUICHENOT, Rev. Zool. Guerin, p. 284, 1847 (type locality, Guam).

SPECIMENS STUDIED

Rongelap Atoll: Lomuilal Island, August 1, 1946, S–46–306, 1 specimen, 67 mm.
Eniwetok Atoll: July 1946, Univ. Washington, 3 specimens, 97 to 121 mm.
Guam: Tumon Bay, January 8, 1946, Gressitt and Ingram, 1 specimen 35 mm.

Description.—Counts are recorded in table 99. Head 2.4 to 2.9; greatest depth 2.6 to 2.9; longest pectoral ray 5.0 to 5.5; snout tip to anus 1.6; snout to dorsal origin 2.7 to 3.0; all in the standard length. Snout 2.7 to 3.0; eye 4.5 to 6.5; postorbital length of head 1.9 to 2.0; interorbital space 3.4 to 3.5; longest pectoral ray, 2.0 to 2.1; least depth of body 1.8 to 2.1; all in length of head. Eye in fleshy interorbital space 1.1 to 3.5. Dorsal profile of head forming an angle 45 to 75 degrees with ventral contour of head, the profile becoming more steep in the large specimens; pectoral fin reaches to opposite the seventh or eighth lateral line pores; outer soft rays of pelvic fins greatly elongate, reaching to anal origin on small specimens and rear of base of anal fin on the largest ones.

Color in alcohol.—Background coloration blackish or dark brown, sometimes with a broad paler bar just behind head; median fins and pelvics blackish edged with white; pectoral fin translucent, each ray edged with a blackish or dark brown line; scales on sides sometimes with light centers.

Genus LABROIDES Bleeker

Labroides BLEEKER, Nat. Tijdschr. Nederl.-Indië, vol. 2, p. 249, 1851 (type species, *Labroides paradiseus* Bleeker).

This genus may be recognized by the following characters: Branched caudal fin rays 6+6; gill rakers very small, about 10 to 12 on first arch; pores in lateral line 25 to 54, with 3 to 5 scales above lateral line and 10 to 18 below it; dorsal rays normally IX,10 or 11; anal III,10 or 11; pectoral ii,11. Body only a little compressed; upper lip incised at tip; lower lip with forward projecting lobe at front of each side, the area between broadly U-shaped; head moderately pointed, dorsal profile a little convex; interorbital space convex; nostrils minute,

TABLE 99.—*Counts recorded for species of* Labroides, Labrichthys, *and* Diproctacanthus

Genus and species	Fin rays												Total number of lateral line pores to base of caudal fin																												
	Dorsal				Anal				Pectoral																																
	VIII	IX	10	11	II	III	9	10	ii	11	12	13	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53
Labroides:																																									
dimidiatus		10		10		10		10	20	20																												1	3	5	1
bicolor		9		9		9		9	20	20				5	4																										
Labrichthys:																																									
cyanotaenia	1	17		18		18		18	36	2	31	3	1	10	6																										
Diproctacanthus:																																									
xanthurus		1	1		1		1		2	2																	1														

	Pores in lateral line																													
	Anterior part																					Peduncular part								
	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	5	6	7	8	9	10	11	12	13
Labroides:																														
dimidiatus																			2	5	3								5	5
bicolor	1	7	1																			5	4							
Labrichthys:																														
cyanotaenia	2	8	4																			12	2							
Diproctacanthus:																														
xanthurus													1											1						

anterior pair with raised rims, slightly tubular; lower jaw a little shorter than upper; a pair of curved canines at front of upper jaw, moderately spaced, and a pair of curved canines far apart at front of lower jaw, concealed by lobes of lip, canines of upper jaw fitting between those of lower jaw when mouth is closed; a narrow band of villiform teeth at front of both jaws; a canine tooth at rear corner of mouth; preopercular margin free posteriorly but not ventrally; head scaled behind eye.

Randall says of the color: "Juveniles of all species appear to have the same basic color pattern, namely black with a broad band of color along the back which extends and narrows on to the head. On *L. dimidiatus* and *L. rubrolabiatus* this band is brilliant deep blue; on *L. bicolor* it is bright yellow; on *L. phthirophagus* it is bright purple."

KEY TO THE SPECIES OF LABROIDES[46]

1*a*. Number of pores in lateral line from upper edge of gill opening to base of caudal fin 50 to 54, color light blue with a median lateral black band from snout to end of caudal fin (this band broadening as it passes posteriorly on body) ------------------ **L. dimidiatus** (Cuvier and Valenciennes)

1*b*. Number of pores in lateral line 25 to 28.

  2*a*. Diameter of eye 2.1 to 2.5 times in the relatively long snout; caudal peduncle and caudal fin pale, latter posteriorly with a prominent black crescent, the attenuate ends of which extend to margins of caudal peduncle. (Tropical Pacific.) ---- **L. bicolor** Fowler and Bean

  2*b*. Diameter of eye 1.5 to 1.9 times in the relatively short snout; caudal peduncle and caudal fin black, with upper and lower edges of fin pale.

    3*a*. Median lateral black band which extends posteriorly from snout continuous with black posterior half of body; no dusky streak on cheek below eye; pale edges of caudal fin magenta in life; maximum standard length in excess of 80 mm. (Hawaiian Islands.) **L. phthirophagus** Randall

    3*b*. Median lateral black band which extends posteriorly from snout merges gradually to broad pale brown (dull orange in life) area in center of body; a narrow dusky streak on cheek below eye running from chin to base of pectoral (may be faint in small adults); pale edges of caudal fin light lavender in life; maximum standard length about 55 mm. (Society Islands and Tuamotu Archipelago.) **L. rubrolabiatus** Randall

LABROIDES DIMIDIATUS (Cuvier and Valenciennes)

PLATE 98,C

Cossyphus dimidiatus CUVIER and VALENCIENNES, Histoire naturelle des poissons, vol. 13, p. 136, 1939 (type locality, Mauritius).

Labroides caeruleo-lineatus FOWLER, Proc. Acad. Nat. Sci. Philadelphia, vol. 97, p. 65, fig. 7, 1945 (type locality, Saipan; immature color pattern).

SPECIMENS STUDIED

Bikini Atoll: 14 stations, 19 specimens 24 to 74 mm. in standard length.

Rongelap Atoll: 4 stations, 7 specimens, 33 to 62 mm.

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[46] Modified from a key sent me by Dr. Randall, who has revised the genus *Labroides*.

Eniwetok Atoll: 1 station, 1 specimen, 66 mm.
Kwajalein Atoll: 1 station, 1 specimen, 54 mm.
Guam: 3 lots, 5 specimens, 26 to 57 mm.
Saipan: 1 lot, 1 specimen, 44 mm.

Description.—Certain counts are recorded in table 99.

Head 2.6 to 3.3, greatest depth 4.1 to 4.8, longest pectoral ray, 5.2 to 5.3, snout tip to anus 1.9; snout to dorsal origin 2.7 to 3.4; all in standard length. Snout 3.2 to 3.5; eye 3.4 to 5.1; interorbital space 1.9 to 2.0; longest pectoral ray 1.7 to 1.9; least depth of body 2.0 to 2.3; all in length of head. Eye in fleshy interorbital space 0.9 to 1.6. Dorsal profile of head forming an angle of 40 to 45 degrees with ventral contour of head; pectoral fin reaches to opposite the fifteenth and seventeenth lateral line pores; outer soft pelvic ray longest; distal margin of caudal slightly rounded.

Color in alcohol.—At lengths of from 40 to 74 mm. background coloration is whitish; a black streak begins on the mouth and extends through eye, across opercular flap, a little above midside of body to rear margin of caudal fin, broadening posteriorly; a narrow black streak or line usually occurs on base of anal fin and thence along ventral edge of the caudal peduncle, curving around ventral part of caudal fin to meet the broadly black center of caudal fin; a black spot occurs between dorsal spines I to III or IV; a dark streak may begin on dorsal surface of snout and continue along base of dorsal fin; axil of pectoral white; a dusky spot or short blackish bar may occur below pectoral fin base.

At lengths of from 24 to 37 mm. background coloration is blackish or dark brownish, underside of head and breast light brown or whitish; distal third of dorsal and anal fins white; dorsal and ventral edges of caudal fin white; the blackish lateral band is slightly visible on head; the light brown band above black band on side begins to appear at these sizes. A 24-mm. specimen is light brownish, with caudal fin blackish centrally.

Color when alive.—The whitish areas are bright blue and the dark areas blackish; pectoral yellowish.

LABROIDES BICOLOR Fowler and Bean

PLATE 98,A,B

Labroides bicolor FOWLER and BEAN, U. S. Nat. Mus. Bull. 100, vol. 7, p. 224, 1928 (type locality, Port Maricaban, Philippines).

SPECIMENS STUDIED

Bikini Atoll: 5 stations, 6 specimens, 15.5 to 91 mm. in standard length.
Rongerik Atoll: 1 station, 1 specimen, 86 mm.
Rongelap Atoll: 1 station, 1 specimen, 24 mm.

An additional specimen, 29 mm. USNM 108514, from the Hawaiian Islands, taken by Otto Degener, July 1937, at Mokuleia, Waialua, is the easternmost record so far for this rare species.

Description.—Certain counts are recorded in table 99.

Head 2.6 to 2.9; greatest depth 3.5 to 4.9; longest pectoral ray 4.2 to 5.6; snout tip to anus 1.6 to 1.7; snout to dorsal origin 2.6 to 2.9; all in standard length. Snout 3.0 to 3.3; eye 4.5 to 6.5; postorbital length of head 1.9 to 2.1; interorbital space 3.7 to 4.5; longest pectoral ray 1.6 to 2.1; least depth of body 2.0 to 2.6; all in length of head. Eye in fleshy interorbital space 1.0 to 1.6. Dorsal profile of head forming an angle of 38 to 43 degrees with ventral contour of head; pectoral fin reaches to opposite the eighth or ninth lateral line pore; outer soft pelvic ray longest reaching about half to two-thirds the way to anus; distal margin of caudal fin a little rounded.

Color in alcohol.—Anterior half of body and head of adults dark brown, posteriorly whitish; dorsal and anal fins blackish or dark brownish basally, distally whitish; caudal fin with a submarginal blackish crescentric band, distal edges of fin whitish; pectoral rays edged with a dark line; pelvics a little dusky.

The color pattern of young specimens, 24 to 48 mm., gradually change to that of the adult as originally figured by Fowler. The 24 and 29 mm. specimens have a dark brown streak along the back that begins at snout tip, passes through interorbital space thence along each side of dorsal fin base ending at rear of dorsal base; dorsal fin dark brown basally, distally white edged. A white streak or band begins on snout tip and passes through upper part of eye and a little of the interorbital space, thence along upper side, including lateral line anteriorly, meeting its fellow on caudal peduncle and continuing to rear tips of upper part of caudal fin rays. A brown band begins on lips, passes through lower three quarters of eye to rear of opercle, thence expands to cover all the body below the white streak except distal tips of anal rays and lower rays of caudal fin, and extending to tips of middle caudal rays. Under side of head light tan.

The 33.5 mm. specimen has the dark streak along the back and the white one through upper part of eye, but the dark brown band through eye and on side of body fades out on caudal peduncle; the caudal fin is white except for a trace of dusky pigment distally. Anal fin edged with white distally. Lower part of body lighter brown on level with upper edge of pectoral base.

The 48 mm. specimen has the middorsal dark streak distinct, the light streak below it light brown, and the lateral dark brown band distinct but ending just a little behind a line through anal fin origin; caudal fin whitish with the crescentric-shaped submarginal dark band on distal part of caudal fin well formed; on the 66 mm. specimen the light streak through upper part of eye is still visible on the head and less so behind the head; otherwise the adult color pattern is fully developed.

Color when alive.—Dark areas purplish dark brown; light areas straw colored; margins of fins white; eye light pinkish. Under side of head and breast light yellowish.

Ecology.—This uncommon species was taken among those coral and algal growths on the reefs exposed to severe wave action.

Remarks.—This species, similar to so many other species of labrid fishes has juvenile color pattern very much different from that of the adult, but from a series of specimens of various sizes, it has been possible to describe the change in color pattern.

The 29-mm. specimen collected by Otto Degener bears the following note by the collector:

"What is this remarkable black and violet fish? It is rare. It is an active swimmer, swimming several feet back and forth and sometimes upward and downward near cavernous coral or coralline ledges. It frequently swims into the dark holes. In an aquarium, it has the tendency to follow other small fish in apparent attempt to crawl on them. It does not bite fish nor did it feed in the aquarium except once to take a minute particle of boiled egg yolk floating in the water. At night, it secretes itself in a crevice."

Genus CHEILIO Lacepède

Cheilio Lacepède, Histoire naturelle des poissons, vol. 4, p. 432, 1802 (type species, *Cheilio auratus* Lacepède).

CHEILIO INERMIS (Forskål)

Plate 107,A

Labrus inermis Forskål, Descriptiones animalium . . ., p. 34, 1775 (type locality, Moccha, Red Sea).

SPECIMENS STUDIED

Guam: December 23, 1945, Frey and Gressitt, 2 specimens, 68 to 76 mm.; 1945, Frey, 2 specimens, 141 to 247 mm.

Description.—Dorsal rays IX,12 or 13 usually IX,13; anal III,11 or 12, usually III,12; pectoral ii,10; pores in lateral line 45 or 46, with 7 above to base of first soft dorsal ray and 10 or 11 to anal origin; pelvics I,5; branched caudal rays 6+6.

Head 2.7 to 3.0; greatest depth 6.0 to 7.8; longest pectoral ray 8.0 to 8.2; snout tip to anus 1.9; snout to dorsal origin 2.6 to 2.7, all in standard length. Snout 2.2 to 2.3; eye 4.6 to 6.0; postorbital length of head 2.3 to 2.6; interorbital space 6.3 to 6.5; longest pectoral ray 2.7 to 2.9; least depth of body 3.7 to 4.8; all in length of head. Eye 0.7 to 1.0 in fleshy interorbital space.

Dorsal profile of head forming an angle of about 25 to 40 degrees with ventral contour of head; pectoral fin reaches to opposite about 10th to 12th lateral line pore; distal margin of caudal fin rounded; interorbital space flattish in young becoming convex in adults; lateral line continuous, running a nearly straight course from upper edge of operculum to midbase of caudal fin, the last lateral line pore in an elongate scale, lateral line multiple branched posteriorly on each scale especially last one; pelvics short, not reaching half way to anus.

Color in alcohol.—Background coloration light tan or whitish, with a dark streak or a series of small spots along lateral line.

Genus CORIS Lacepède

Coris Lacepède, Histoire naturelle des poissons, vol. 3, pp. 96, 97, 1802 (type species, *Coris aygula* Lacepéde).

The following characters are useful in recognizing this genus: Pelvics I,5; branched caudal rays 6+6; lateral line scales totaling 50 to 80; usually 4 to 7 rows above lateral line and 19 to 32 below to anal origin; dorsal rays usually IX,11 or 12, anal III,11 or 12, and pectoral ii,11 or 12; gill rakers about 5 to 7+1+10 to 12; body strongly compressed; snout normal; dorsal profile of head convex; interorbital space convex; jaws terminal, equal or nearly so; teeth short, conical, uniserial, anterior ones longest, middle pair in each jaw canines, extending obliquely forward, lower pair fitting between upper pair, preopercular margin free posteriorly and an equal distance ventrally; gill membranes broadly joined and forming a broad free fold across isthmus; preopercular edge free as much posteriorly as ventrally; head naked; no sheath of scales along bases of dorsal and anal fins.

The species of *Coris* from the Marianas and Marshall Islands are separated by the following key:

1*a*. Vertical scale rows 71 to 75; pectoral rays ii,11; 5 dark bordered pale areas dorsally on young; adults purplish brown with posterior part of body profusely blue spotted, these spots preserving as white or brown in alcohol; head with 3 or 4 dark lengthwise streaks.
C. gaimardi (Quoy and Gaimard)

1*b*. Vertical scale rows 60 to 65; pectoral rays ii,12; anterior part of body abruptly paler than posterior part, and brown spotted; coloration becoming plain blackish in large adults------------------------**C. aygula** Lacepède

1*c*. Vertical scale rows about 52 to 53; pectoral rays ii,12; a black spot between dorsal spines I and II, and a black ocellate spot on soft dorsal rays 1 to 3; adults brownish with dusky and pale bars dorsally; scales on lower parts of body with white centers-------------**C. variegata** (Rüppell)

Table 100.—*Counts recorded for certain species of* Coris

Species	Fin rays							Vertical scale rows												
	Dorsal		Anal		Pectoral			51 52	53 54	55 56	57 58	59 60	61 62	63 64	65 66	67 68	69 70	71 72	73 74	75 76
	IX	12	III	12	ii	11	12													
gaimardi	8	8	8	8	16	16	---	---	---	---	---	---	---	---	---	---	---	4	3	1
aygula	8	8	8	8	16	---	16	---	---	---	---	1	3	2	2	---	---	---	---	---
venusta	3	3	3	3	6	6	---	3	---	---	---	---	---	---	---	---	---	---	---	---
philippina	2	2	2	2	4	4	---	---	---	---	---	---	1	---	---	1	---	---	---	---
variegata	1	---	---	---	---	1	---	1	---	---	---	---	---	---	---	---	---	---	---	---

Species	Pores in lateral line																											
	Anterior part																		Oblique part				Peduncular part						
	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	4	5	6	7	9	10	11	12	13	14	15
gaimardi	--	--	--	--	--	--	--	--	--	--	--	--	--	3	1	3	---	1	---	---	4	4	---	---	---	---	---	5	3
aygula	--	--	--	--	--	--	1	--	1	5	1	--	--	---	---	---	---	---	---	6	2	---	1	---	3	2	1	1	---
venusta	3	--	--	--	--	--	--	--	--	--	--	--	--	---	---	---	---	---	3	---	---	---	---	2	1	---	---	---	---
philippina	--	--	--	--	--	--	--	1	--	--	--	1	--	---	---	---	---	---	---	2	---	---	---	---	---	---	1	1	---
variegata	--	1	--	--	--	--	--	--	--	--	--	--	--	---	---	---	---	---	1	---	---	---	---	1	---	---	---	---	---

CORIS GAIMARDI (Quoy and Gaimard)

Plate 97, A–E

Julis gaimard Quoy and Gaimard, Voyage autour du monde . . . sur . . . l'*Uranie* et la *Physicienne*, Zoologie, p. 265, pl. 54, fig. 1, 1824 (type locality, Maui, Hawaiian Islands).

Labrus formosus Bennett, Fishes found upon the Coast of Ceylon, p. 16, pl. 16, 1834 (type locality, Ceylon).

Coris pulcherrima Günther, Catalogue of the fishes in the British Museum, vol. 4, p. 200, 1862 (type locality, Amboyna, Tahitti, Aneiteum).—Seale, Occ. Pap. Bishop Mus., vol. 1, p. 87, 1901 (Guam).

Julis greenovii Bennett, Zool. Journ., vol. 4, p. 37, 1829 (type locality, Hawaiian Islands).—Jordan and Evermann, Bull. U. S. Fish. Comm., vol. 23 (1903), pt. 1, p. 308, pl. 30, 1905 (Hawaiian Islands; Apia, Samoa).—Jordan and Seale, Bull. U. S. Bur. Fish., vol. 25 (1905), p. 304, 1906 (Apia).

Coris gaimardi Bleeker, Atlas ichthyologique . . ., vol. 1, p. 99, pl. 19, fig. 2, 1862 (Moluccas).

Coris formosa Bleeker, Atlas ichthyologique . . ., vol. 1, p. 99, pl. 19, fig. 3, 1862 (Celebes; Amboina).

Coris greenoughii Günther, Ann. Mag. Nat. Hist., vol. 8, p. 387, 1861; Catalogue of the fishes in the British Museum, vol. 4, p. 204, 1862.—Bleeker, Atlas ichthyologique . . ., vol. 1, p. 100, pl. 31, fig. 2, 1862 (Celebes: Buro).

Julis (Julis) leucorrhynchos Bleeker, Act. Soc. Sci. Indo-Néerl., vol. 1, p. 57, 1856 (type locality, Manado).

Julis gaimard speciosa Fowler, Proc. Acad. Nat. Sci. Philadelphia, vol. 98, p. 171, fig. 37, 1946 (type locality, Riu Kiu Islands).

SPECIMENS STUDIED

Bikini Atoll: 4 stations, 4 specimens, 13 to 210 mm. in standard length. 2 lots, Univ. Washington, 3 specimens, 36 to 149 mm.

Rongelap Atoll: 2 stations, 3 specimens, 78 to 169 mm.

Eniwetok Atoll: 1 station, 2 specimens, 72 to 110 mm.

Kwajalein Atoll: 1 lot, Univ. Washington, 1 specimen, 210 mm.

Description.—Dorsal rays IX,12; anal III,12; pectoral ii,11; pores in lateral line 50 to 52+6 or 7+14 or 15; vertical scale rows 70 to 73; gill rakers 5 to 7+1+10 to 12. See table 100 for additional counts and for those recorded for other species of *Coris*.

Head 2.6 to 3.2; greatest depth 2.5 to 3.3; longest pectoral ray 4.6 to 5.0; snout tip to anus 1.8 to 2.1; snout to dorsal origin 2.7 to 3.0; all in standard length. Snout 2.8 to 4.0; eye 3.2 to 6.7; postorbital length of head 1.8 to 2.0; interorbital space 4.0 to 4.3; longest pectoral ray 1.6 to 2.1; least depth of body 2.3 to 2.5; all in length of head. Eye in fleshy interorbital space 0.8 to 1.7.

Dorsal profile of head forming an angle of about 65 to 70 degrees with the ventral contour of head; pectoral fin reaches to opposite about the 24th to 27th lateral line pores; outer rays of pelvics longest, greatly elongate in adults, reaching past anal origin; first and second dorsal rays of adults greatly elongate, sometimes nearly as long as head; distal margin of caudal fin rounded.

Color in alcohol.—The series of specimens collected at Johnston Island and in the Marshall Islands, along with others in the U. S. National Museum, has demonstrated that this species has a most remarkable change in color pattern between the young and adult stages. The following color descriptions are based on that material:

Young, 13 to 52 mm.: Background coloration whitish, with 5 dark brown or blackish bordered white areas dorsally, first on snout, second from rear of interorbital space to occiput and extending ventrally to about opposite middle of rear edge of orbit, third from front of spiny dorsal fin ventrally and becoming wedge-shaped and ending on lower side in axil of pectoral, fourth between soft dorsal rays 4 to 8 and extending nearly to midside of body and sometimes to distal edge of soft dorsal, fifth at rear edge of soft dorsal and on dorsal half of caudal peduncle; middle of caudal fin crossed with a blackish bar, except in the 13 mm. specimen; distal edges of dorsal and anal fins blackish, except in 13 mm. specimen.

Intermediate sizes, 60 to 82 mm.: The dark bordered pale areas are distinct but the body has generally become brownish or tinged with brownish. The 60-mm. specimen is lighter than the larger ones, and the 72- and 82-mm. specimens are brown with the caudal peduncle and basal part of the caudal fin dark brown; blackish bar on caudal fin distinct, distally whitish; dorsal and anal fins bear a dusky streak along their middle in addition to dark line distally. Axil of pectoral brownish in 60-mm. specimen, dark brown in 72- and 82-mm. specimens. On the 82-mm. specimen a few dusky spots (blue when alive) have formed. Near base of each dorsal and anal ray occurs a small brownish spot.

Adult coloration, 78 mm. and Larger: The 78-mm. specimen has lost all the dark-bordered pale areas except a trace of third; the body is dark brown to blackish, except that the head is whitish anteriorly; the dark streaks on the head are beginning to form; caudal whitish in distal two-thirds; dusky spots (blue when alive) very numerous, more so posteriorly; pectoral axil black. On specimens 110 to 210 mm. the background coloration is dark brown or blackish; head whitish anteriorly; dorsal and anal fins with distal edge white, then a dark submarginal line, basal two-thirds of fins with dusky spots, usually a dark spot near base of each ray; distal three-fourths of caudal fin white; pectoral white; head with a dark streak at mid-dorsal line posteriorly; another brownish streak from snout past dorsal part of eye and thence to each side of base of front of spiny dorsal fin; a brown streak from middle of posterior edge of eye across opercle to opercular flap; a brown streak begins at corner of mouth then curves to lower edge of eye and thence backward across gill cover to opposite pectoral base; a dusky streak extends on ventral surface of head from under lower jaw to pelvic base; body profusely covered with either brownish or whitish specks, depending on preservation.

Color when alive.—Background coloration reddish brown; head dull reddish, body specked, profusely so posteriorly, with bright blue, these bright spots in preservation may be white or brown; dorsal and anal fins reddish with 2 or 3 blue lines distally and usually blue spots basally; caudal bright yellow, except base is bluish brown; pectoral reddish; the streak on snout and dorsal part of head blue; the streak behind eye, below it and on under side of head brownish green; outer ray of pelvic bluish.

Ecology.—This species was rather rare in the intertidal zone of the reefs. It preferred the deeper waters of the lagoon.

Remarks.—The extensive series of specimens in the U. S. National Museum from 13 to 280 mm. in standard length have made it possible for me to follow the juvenile color pattern through successive stages to that of the adult. These data indicate conclusively that *Coris greenovii* is a synonym of *C. gaimardi.*

CORIS AYGULA Lacepède

FIGURE 99; PLATE 98,D,E,F

Coris aygula LACEPÈDE, Histoire naturelle des poissons, vol. 3, pp. 96, 97, pl. 4, lower figure, 1802 (no locality).—SEALE, Occ. Pap., Bishop Mus., vol. 1, No. 3, p. 87, 1901 (Guam).

Coris angulatus LACEPÈDE, Histoire naturelle des poissons, vol. 3, pp. 97, 99, pl. 4, middle figure (no locality).

SPECIMENS STUDIED

Bikini Atoll: 9 stations, 21 specimens, 34 to 215 mm. in standard length.
Rongerik Atoll: 1 station, 2 specimens, 40 to 41 mm.
Rongelap Atoll: 5 stations, 9 specimens, 35 to 57 mm.
Guam: 1 lot, 1 specimen, 166 mm.

Description.—Dorsal rays IX,12; anal III,12; pectoral ii,12; pores in lateral line 43 to 47+5 or 6+11 to 14; vertical scale rows 60 to 65, with 5 scales above lateral line and 21 to 23 below to anal origin; gill rakers about 7+1+9 to 11.

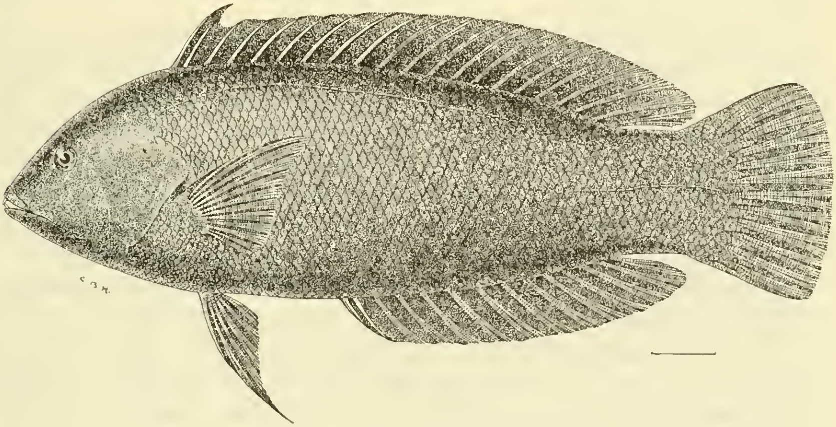

FIGURE 99.—*Coris aygula* Lacepède, after Jordan and Snyder.

Head 3.0 to 3.2; greatest depth 3.1 to 3.3; longest pectoral ray 5.0 to 5.5; snout tip to anus 2.0; snout to dorsal origin 2.8 to 3.0; all in standard length. Snout 2.6 to 3.4; eye 4.0 to 6.2; postorbital length of head 1.9 to 2.0; interorbital space 4.1 to 4.2; longest pectoral ray 1.7 to 1.9; least depth of body 2.0 to 2.4; all in length of head. Eye in fleshy interorbital space 0.8 to 2.0.

Dorsal profile of head forming an angle of about 50 to 70 degrees with the ventral contour of head; pectoral fin reaches to opposite about the 18th to 21st lateral line pores; outer rays of pelvics longest, greatly elongate in adults, reaching past anal origin; first and second dorsal rays greatly elongate on the 310 mm. specimen (head of this specimen with a prominent bulge); distal margin of caudal fin rounded in juveniles, truncate in small adults, the caudal rays becoming exerted in the largest adults.

Color in alcohol.—Juveniles (between 34 and 57 mm. in standard length) have the background coloration whitish or light tan and the anterior part of the body and head spotted with dark brown or blackish, and the posterior half plain in color; back with two dark-bordered, pale roundish areas enclosing on dorsal fin a black spot, the first ring extending on last three dorsal spines and first three soft dorsal rays, the second ring at rear of soft dorsal and the black spot on dorsal soft rays 9 to 11; base of caudal with a black bar, this intensified with a black spot on dorsal half of base; caudal fin otherwise white, except that a small amount of black pigment may occur in some specimens, dorsal fin with dark spots, distal edge white; anal fin blackish, distal edge white; pectorals white. A 57-mm. specimen has dark anal and dorsal fins and the caudal fin broadly white edged, with its center blackish.

Young (between 91 and 165 mm.) have the background coloration whitish anteriorly and brown spotted in front of a vertical line through anal fin origin, behind this line, the back is plain blackish or plain dark brown and ventrally pale or whitish; dorsal and anal fins blackish, with distal edges white; caudal fin blackish or dark brown, with darker spots evident, the distal edges of fin white. A 57-mm. specimen has traces of the two round pale areas on back, but posterior part of body dark brown and median fins blackish with white margins.

Adults (between 121 and 310 mm.) have the background coloration dark brown posteriorly, abruptly light brown anteriorly, the sharp demarcation occurring over anal fin origin; head brown, the brown or reddish brown spots on head preserve as white in alcohol, or sometimes brownish, and are much fewer in number than on smaller specimens; dorsal, anal, caudal fins blackish, edged with white; pectoral fin light tan, its base dark brown, axil dark brown; pelvics dark brown; opercular flap edged with white, and with a dark spot; one specimen at 196 mm. is plain dark brown, except for a pale bar opposite tip of pectoral fin; at a length of 310 mm. the coloration is plain blackish.

Color when alive.—The spots on the head and anterior part of the body are red, reddish brown, or brownish red, and the background of the body in front of a vertical line through the anal fin origin is white; the pale areas around the black ocellate spots on dorsal fin are orange; margins of dorsal and anal fin yellow; pale areas of caudal fin yellow.

Ecology.—The smaller specimens of this species were taken in the shallow waters of the reefs whereas the larger specimens came from deeper waters. The largest specimen, 310 mm., was speared in the lagoon at a depth of 30 to 45 feet.

Remarks.—This species shows a remarkable change in color pattern from the smallest specimens to the largest. Those 13 to 57 mm. are whitish or light tan, dark-spotted anteriorly, with two orange areas on back enclosing two black ocellate spots on dorsal fin; as they get larger, the pale areas disappear, dark spots disappear, and the entire fish becomes plain blackish, except narrow white margins of median fins.

CORIS VARIEGATA (Rüppell)

PLATE 97,G

Halichoeres variegatus RÜPPELL, Neue Wirbelthiere zu der Fauna von Abysinnien Gehörig, Fische, p. 14, pl. 4, fig. 2, 1835 (type locality, Djedda).

SPECIMENS STUDIED

Bikini Atoll, off Amen Island, lagoon, depth 30 feet, August 4, 1946, S–46–307 Herald and Brock, 1 specimen, 53 mm.

Description.—Dorsal rays IX,11; anal III,11; pectoral ii,11–ii,11; pores in lateral line 38 or 39 + 4 + 10, with 5 scales above lateral line and 19 below to anal origin.

Head 2.9; greatest depth 3.3; longest pectoral ray 4.9; snout tip to anus 1.8; snout to dorsal origin 2.7; all in standard length. Snout 2.8; eye 4.0; postorbital length of head 2.1; fleshy interorbital space 3.8; longest pectoral ray 1.7; least depth of body 2.2; all in the length of head.

Dorsal profile of snout forming an angle of 58 degrees with ventral contour of head; pectoral fin reaches to opposite lateral line pores 18 or 19; first soft ray of pelvic longest, not quite reaching anus; distal margin of caudal fin a little rounded.

Color in alcohol.—Background coloration whitish or pale, with 6 narrow dusky bars dorsally; a black spot in membrane between dorsal spines I and II, a black ocellate spot between soft dorsal rays 1 to 3, and a small black spot near middle of soft dorsal ray 9; a dark blotch just behind orbit; upper two-thirds of pectoral base with an oblong dark spot. Other characteristic color markings found on larger members of this species are lacking on this specimen.

Genus THALASSOMA Swainson

Thalassoma SWAINSON Natural history and classification of fishes . . ., vol. 2, pp. 172, 224, fig. 57b, 1839 (type species, *Julis purpureus* Rüppell, Atlas zu der Reise im nördlichen Afrika (Fische des rothen meers), pl. 6, fig. 2, 1828 = *Scarus purpureus* Forskål).

The following features are the same for all species of this genus: Body a little compressed; snout normal, not notably elongate;

maxillary covered by preorbital; premaxillary protractile; jaws equal in length or nearly so; gill membranes joined to side of isthmus but with a narrow free fold across it; head naked, except a few scales in a patch on upper part of opercle usually present; body scaled; all fins naked, except caudal fin scaled basally; lateral line complete; usually branched pectoral ray second from dorsal edge longest; dorsal rays VIII,12 to 14 almost always VIII,13; anal III,10–13 almost always III,11; pectoral rays ii,12 to 15; pores in lateral line 19 or 20+1 (rarely 2) +5 or 6 to base of caudal fin rays; 3 or 4 scales above lateral line to base of spiny dorsal and 9 or 10 scales below it to anus; pelvics I,5; branched caudal rays 6+6; nostrils small, anterior one tubular, posterior nasal opening covered by a dermal flap arising from its anterior edge; interorbital space convex; teeth short on sides, uniserial, about 9 to 14 on each side in both jaws, usually tips curved a little posteriorly; middle pair of enlarged teeth on lower jaw fitting between the middle pair at tip of upper jaw when mouth is closed, these teeth obliquely slanting, not projecting straight forward; both lips plicate, this condition usually continuing on chin.

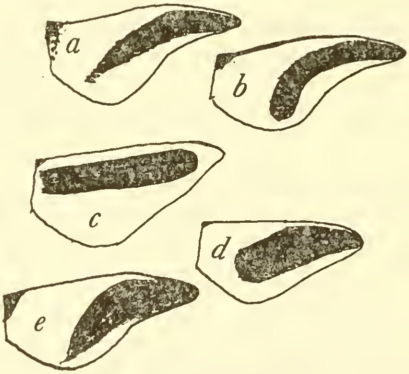

FIGURE 100.—Sketch showing the shape of the dark color bar in the pectoral fin of five species of *Thalassoma: a, T. duperry* (Quoy and Gaimard); *b, T. lucasanum* (Gill); *c, T. lunare* (Linnaeus); *d, T. lutescens* (Lay and Bennett); *e, T. amblycephalus* (Bleeker).

KEY TO SPECIES OF THALASSOMA FROM THE MARSHALL AND SOUTHERN MARIANAS ISLANDS

1*a*. Color pattern consisting of about 6 or 7 blackish, wedge-shaped, vertical bars interspaces whitish; radiating from eye about 5 broad dusky bars (red when alive) alternating with pale ones (olive when alive) of about same width; dorsal fin with a blackish median streak.

T. hardwickei (Bennett)

1*b*. Color pattern not as in 1*a*.

2*a*. Operculum crossed with 3 or 4 narrow curved streaks or whitish lines often obscure in preserved specimens, head dark brown, body lighter brown; chin without plicate folds; 2 dark bars across pale chin; centers of

scales sometimes with a dusky vertical line; upper part of pectoral fin with a dark blotch, rest of fin pale; (fig. 100,*c*).
T. lunare (Linnaeus)

2*b*. Side of head crossed with 2 narrow blue streaks, one from near snout tip past lower part of eye across operculum and ending at level of upper edge of pectoral base; other from corner of mouth and curving across cheek to breast; chin without plicate folds; posterior part of pectoral fin blackish; dorsal half of pectoral base blackish; chin plain brownish or dusky in adult____________________**T. amblycephalus** (Bleeker)

2*c*. Coloration not as in 2*a* or 2*b*.

3*a*. On sides and back occur 1 (in very small specimens) to 3 rows of dark blotches, each blotch composed of 5 or 6 or more dark brown vertically elongate spots or short streaks, first row along back, then two more on sides; in young the median row only occurs and appears to be made up of W-shaped blotches; dorsal half of head with brown spots and lines, lower part plain pale__**T. umbrostygma** (Rüppell)

3*b*. Coloration not as in 3*a*.

4*a*. Sides of body with evenly spaced, vertically elongate dark brownish lines or streaks, one crossing each scale; head plain light brownish; background color of body light brownish.
T. ballieui (Vaillant and Sauvage)

4*b*. Coloration not as in 4*a*.

5*a*. Sides of adults without any pale or darkish lengthwise streaks; young with black lateral streak and another blackish streak along back, separated by pale band; background coloration of body pale, or light brownish yellow, with head darker in adults.

6*a*. Pectoral rays ii,14; chin with plicate folds.

7*a*. Side of head usually with 4 or 5 dusky bands separated by pale interspaces; blackish spot between first to third dorsal spines; on adults, each scale may have a narrow dusky to brownish vertical line, but sometimes this color mark is scarcely visible; young from 23 to 50 mm. have a dark lateral streak along middle of side, and a dark caudal spot; underside of chin without dark crossbar.
T. lutescens (Lay and Bennett)

7*b*. Head plain dark brown, darker than body; usually a broad pale bar just behind head on adults; inner ventral part of pectoral fin base brownish; dorsal and anal fins plain dark brown; distal edge of caudal fin of adults brown; distal edge of dark brown dorsal and anal fins at most only white; (fig. 100,*a*)_____________**T. duperry** (Quoy and Gaimard)

6*b*. Pectoral rays ii,13; chin not plicate but smooth.

8*a*. Side of head crossed with 2 narrow blue streaks; dark blotch distally on pectoral fin extends to tip of upper rays; caudal fin generally dark brown distally.
T. amblycephalus (Bleeker)

8*b*. Upper half of head and body dark brown, with no light band along back; outer edges of caudal fin rays blackish distally; remainder of fin lighter in color; (fig. 100,*b*; pl. 99,D).
T. lucasanum [47] (Gill)

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[47] *Julis lucasanus* Gill, Proc. Acad. Nat. Sci. Philadelphia, vol. 14, p. 142, 1862 (type locality, Cape San Lucas).

8*c*. Side of head plain brown; dark blotch on pectoral fin narrow and not extending to tips of rays; distally the caudal fin is brown..................... **T. steindachneri**[48] Jordan

5*b*. Sides with one or two whitish or dark bands, with or without narrow white transverse or vertical streaks.

9*a*. Background coloration light olive to dark brown or blackish, with 2 pale lengthwise streaks usually visible on sides, one along upper side and the other along middle, these bordered above and below by blackish streaks, often composed of a dark blotch on each scale; radiating from eye 6 dusky to blackish streaks; lips and chin whitish; in small specimens, dorsal fin has a black spot between first to third spines, another between second and third soft rays, and one at base of each dorsal fin ray, but this may be lacking at bases of fifth and ninth rays..**T. quinquevittata** (Lay and Bennett)

9*b*. No pale band on operculum and breast as in *T. purpureum;* margin of operculum pale (blue when alive); background coloration light brown to brownish; two brownish bands (green blotches when alive), one along upper side and the other along middle of side; blotches connected by orange lines, the pale interspaces orange or reddish; head orange, upper lips blue, chin blue; two blue spots over eye, one below it.
T. fuscum (Lacepède)

9*c*. A pale band (orange when alive) extends from rear of orbit obliquely downward across operculum, forking posteriorly, thence continuing on breast as a band under pectoral fin base; front of snout reddish with a green streak across snout just above lips; lips and rest of head green; background coloration light brownish or olive, a dusky or brownish band (reddish when alive) on back, lower sides with 2 pale bands (reddish when alive) connected by vertical pale lines.
T. purpureum (Forskål)

THALASSOMA HARDWICKEI (Bennett)

PLATE 107,D

Sparus hardwicke BENNETT, Fishes found upon the coast of Ceylon, p. 12, pl. 12, 1834 (type locality, Ceylon).

SPECIMENS STUDIED

Bikini Atoll: 3 stations, 3 specimens 26 to 91 mm. in standard length.
Eniwetok Atoll: 1 station, 1 specimen, 46 mm.
Rongelap Atoll: 3 stations, 6 specimens, 25 to 93 mm.
Rongerik Atoll: 2 stations, 4 specimens, 41 to 60 mm.
Likiep Atoll: 1 lot, Univ. Washington, 16 specimens, 40 to 104 mm.

Description.—Certain counts are recorded in table 101.

Head 2.9 to 3.0; greatest depth 3.0 to 3.2; longest pectoral ray 4.3 to 5.0; snout tip to anus 1.7 to 1.8; snout to dorsal origin 2.7; all in standard length. Snout 2.9 to 3.1; eye 3.6 to 5.0; postorbital length

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[48] *Thalassoma steindachneri* Jordan, Rep. U. S. Comm. Fish., vol. 15, p. 654, 1887 (type locality, Acapulco; after Steindachner; not *Julis melanochir* Bleeker).

TABLE 101.—*Counts recorded for various species of* Thalassoma.

Species	Pectoral fin rays					Gill rakers on first gill arch												Total rakers on first gill arch									
						Above angle					At angle	Below angle															
	ii	12	13	14	15	5	6	7	8	9	1	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
duperry	30		2	26	2			6	3		9			2	6	1						1	5	3			
amblycephalus	39	2	37			14	2				16	1	9	5	1			1	8	5	2						
lucasanum	36	7	29			5	5				10	8	2					4	5	1							
lutescens	30		1	28	1			4	4		8		1	3	1	3						2	2	3	1		
quinquevittata	15		2	13					2		2					1	1								1	1	
hardwickei	22		3	18	1				2	1	3				1	1	1							1	1	1	
lunare	10		10				5				5		3	2						3	2						
umbrostygma	16		1	15				3			3			1	2							1	2				
ballieui	2		1	1						1	1						1										1
fuscum	4			4				2			2		1	1							1	1					
purpureum	10			10				1	1		2				2								1	1			

of head 2.0 to 2.1; interorbital space 4.4 to 4.7; longest pectoral ray (second branched) 1.4 to 1.5; least depth of body 2.2 to 2.3; all in length of head. Distance between anterior and posterior nasal openings 3.1 to 5.1 in snout. Eye 0.7 to 1.1 in interorbital space.

Dorsal profile of head evenly convex, forming an angle of about 60 to 65 degrees with ventral contour of head; pectoral fin reaches to opposite tenth or eleventh pore of lateral line; pelvics reach two-thirds of the way to the anus; distal edge of caudal peduncle a little rounded on smallest, truncate on largest specimens.

Color in alcohol.—Background coloration grayish, white below, grayish dorsally, upper sides with 6 or 7 wedge-shaped black bars that disappear a little below midlengthwise axis, this black bar about 2 or 3 scales wide dorsally; dorsal fin usually with a lengthwise median black streak; basally and distally the dorsal fin is pale, sometimes it is plain whitish without color marks; anal fin with or without a black spot anteriorly, remainder of anal fin plain whitish; base of pectoral blackish anteriorly and dorsally. Radiating from eye are about 5 broad dusky bars alternating with pale ones of approximately the same width.

Color when alive.—The black bars have a reddish tinge and the radiating bars from eye are red with the interspaces olive; median fins light yellowish; dorsal and ventral subedges of the caudal fin with a dull red streak.

Ecology.—This species was uncommon on the reef and occurred only sparingly in the intertidal region of the reefs.

THALASSOMA LUNARE (Linnaeus)

FIGURE 100,*c;* PLATE 106,A

Labrus lunaris LINNAEUS, Systema naturae, ed. 10, p. 283, 1758 (type locality, India).

Thalassoma herrei SEALE, Proc. California Acad. Sci., ser. 4, vol. 21, No. 27, p. 369, pl. 23, fig. 2, 1935 (type locality, Florida Island).

SPECIMENS STUDIED

Jaluit Atoll: January 12, 1900, *Albatross*, 1 specimen, 116 mm.

Description.—Certain counts are recorded in table 101.

Head 3.4; greatest depth 3.5; longest pectoral ray 4.9; snout to anus 1.8; snout to dorsal origin 3.0; all in standard length. Snout 2.8; eye 6.0; postorbital length of head 1.9; interorbital space 4.5; longest pectoral ray 1.5; least depth of body 1.8, all in length of head. Distance between anterior and posterior nasal openings 5.0 in snout. Eye 1.3 in interorbital space.

Dorsal profile of head convex, front of head forming an angle of about 65 to 70 degrees with ventral contour of head; pectoral fin reaches to opposite ninth lateral line scale; pelvics reach halfway to anus; caudal fin forked.

Color in alcohol.—Head dark brown, body light brown; operculum crossed with 3 or 4 narrow whitish streaks; base of caudal fin dark brownish; dark brown blotch in upper half of pectoral fin, dorsal edge of pectoral distally and ventrally hyaline; dorsal edge of pectoral base with a black spot; a brown bar from corner of mouth, meeting its fellow ventrally on underside of jaw, area in front and behind whitish, tip of lower jaw brown; middle of dorsal and anal fins with a brown streak; distally these fins are whitish.

THALASSOMA UMBROSTYGMA (Rüppell)

PLATE 99,E

Julis umbrostygma RÜPPELL, Neue Wirbelthiere zu der Fauna von Abysinnien gehörig, Fische, p. 11, pl. 3, fig. 2, 1835 (type locality, Mohila and Djedda, Red Sea).

Julis punctatus SEALE, Occ. Papers Bishop Museum, vol. 1, No. 3, p. 91, 1901 (type locality, Guam).

SPECIMENS STUDIED

Bikini Atoll: 13 stations, 65 specimens, 16 to 183 mm. in standard length.
Rongerik Atoll: 3 stations, 12 specimens, 21 to 119 mm.
Eniwetok Atoll: 3 stations, 6 specimens, 48 to 126 mm.
Rongelap Atoll: 2 stations, 16 specimens, 14 to 145 mm.
Kwajalein Atoll: 1 station, 7 specimens, 36 to 149 mm.
Guam: 3 lots, 19 specimens, 14 to 43 mm.

Description.—Certain counts are recorded in table 101.

Head 2.8 to 3.3; greatest depth 3.2 to 3.4; longest pectoral ray 4.6 to 5.2; snout tip to anus 1.7 to 1.9; snout to dorsal origin 2.7 to 2.9; all in standard length. Snout 2.9 to 3.1; eye 3.5 to 7.5; postorbital length of head 1.9; interorbital space 4.1 to 4.6; longest pectoral ray 1.5 to 1.9; least depth of body 2.1 to 2.2; all in length of head. Distance between anterior and posterior nasal openings 3.0 to 7.5 in snout. Eye 0.8 to 2.0 in interorbital space.

Dorsal profile convex; pectoral fin reaches to opposite ninth or tenth lateral line scale; pelvics reach about halfway to anus, no rays elongate; outer caudal fin rays not elongate; distal margin of caudal fin a little rounded in young, truncate in half-grown, and becoming double concave with middle a little convex in adults.

Color in alcohol.—Background coloration light grayish or yellowish white; dorsal surface and upper sides of head with blackish spots or dashes more or less forming a loosely connected network; sides with 3 lengthwise rows of 6 dark W-shaped blotches, middle row present in specimens as short as 14 mm., whereas dorsally and ventrally located rows have not developed at that size; W-shaped dark blotches in median row develop at 20 to 25 mm., whereas in smaller specimens the blotches are roundish. Black spots between first to third spines in dorsal fin and a smaller blackish spot near base of third to fourth soft dorsal rays in specimens 40 mm. and shorter; dorsal and anal fins with a pale or dusky streak near middle of fins; tips of pectorals usually dusky; caudal and pelvics plain pale.

Color when alive.—Background coloration light green. Dorsal and anal fins with a lengthwise green band through middle of fins.

THALASSOMA LUTESCENS (Lay and Bennett)

FIGURE 100,D; PLATE 107,B

Julis lutescens LAY and BENNETT, Fishes, *in* Zoology of Captain Beechey's voyage, p. 65, pl. 19, fig. 2, 1839 (type locality, Tahiti and Riu Kiu Islands).

Julis aneitense GÜNTHER, Catalogue of the fishes in the British Museum, vol. 4, p. 183, 1862 (type locality, Aneiteum, Ceto Island, northeast Australia, Norfolk Island).

Julis anertensis SEALE, Occ. Pap. Bishop Museum, vol. 1, No. 3, p. 90, 1901 (Guam; misspelling for *aneitensis*).

Thalassoma neanis JORDAN and SNYDER, Bull. U. S. Bur. Fish., vol. 26 (1906), p. 14, pl. 12, fig. 2, 1907 (type locality, Honolulu, holotype, USNM No. 57785).

SPECIMENS STUDIED

Bikini Atoll: 18 stations, 78 specimens, 14 to 132 mm. in standard length.
Eniwetok Atoll: 1 station, 5 specimens, 66 to 123 mm.
Rongerik Atoll: 3 stations, 6 specimens, 23 to 63 mm.
Rongelap Atoll: 10 stations, 55 specimens, 30 to 100 mm.
Kwajalein Atoll: 1 station, 1 specimen, 41 mm.
Northern Marshall Islands: 1 lot, 15 specimens, 44 to 89 mm.
Likiep Atoll: 1 lot, Univ. Washington, 12 specimens, 41 to 76 mm.

Description.—Certain counts are recorded in table 101. Head 2.9 to 3.2; greatest depth 3.1 to 3.3; longest pectoral ray 4.0 to 4.8; snout tip to anus 1.7 to 1.8; snout to dorsal origin 2.7 to 2.9; all in standard length. Snout 2.9 to 3.2; eye 4.0 to 6.5; postorbital length of head 1.9 to 2.1; interorbital space 4.2 to 4.6; longest pectoral ray 1.4 to 1.7; least depth of body 2.1 to 2.2; all in length of head. Distance between anterior and posterior nasal openings 4.0 to 6.0 in snout. Eye 0.8 to 1.5 in interorbital space.

Pectoral fin reaches to opposite about ninth lateral line scale; pelvics reach a little over halfway to anus; outer caudal rays elongate on adults; distal margin of caudal fin in young convex, becoming concave and even forked in adults.

Color in alcohol.—Background light brownish to light yellowish; head with 4 or 5 dusky streaks separated by wider pale interspaces; pelvics whitish; pectoral fin with blackish blotch, except in young specimens; dorsal edge of pectoral base with dusky spot; dorsal fin with dusky streak basally, distal half whitish; anal fin with dusky streak in basal fifth, distal four-fifths whitish; caudal fin lighter in color than body; each scale with a narrow dusky to brownish vertical line in adults, this color mark often scarcely visible; small blackish spot between first to third dorsal spines; specimens about 50 mm. in length usually have a small dark spot at middorsal line near tip of snout.

Characteristic of those between 23 and 50 mm. in standard length is a small black spot just above midline at base of caudal fin, a blackish lateral streak from behind eye to base of caudal fin, and a blackish dot at tip of snout. The blackish streak is about as wide as pupil to two-thirds width of eye and it varies in intensity; at its greatest intensity, it is composed of blackish or dark brownish scales and is one scale row wide, becoming narrower on caudal peduncle and fading out there; when not fully developed it is a series of small brown spots. This lateral streak may be darkest on those 25 to 45 mm. long; however, three specimens, 36 to 41 mm., have an indistinct dark streak just behind head, and the caudal spot is scarcely visible. The darkish nasal spot, caudal fin spot and spot at dorsal edge of pectoral fin base are but weakly developed.

Color when alive.—Background coloration variable from light brownish yellow in small specimens (51 mm.) to reddish orange (99 mm.) and green in largest specimen (123 and 132 mm.). Middle of dorsal fin with green-lined, reddish orange band; anal fin at base with similar band; outer rays of caudal fin reddish orange; rest of fin yellow; distal part of dorsal and of anal fins yellow; background coloration in 132-mm. specimen light green behind head, sides with purplish red vertical lines (usually light brownish in alcoholic specimens). Head with dusky orange bands as follows: One over eye; one on side of snout in front of eye; then two from rear of eye, that from dorsal edge of eye extending in a curve along dorsal part of operculum and thence ventrally to dorsal edge of pectoral base, that from lower part of eye curving across preopercle and ending a little in front of pectoral fin base; another begins at corner of mouth, extends below eye curving across preopercle, and continuing on body below pectoral fin base; the one from lower jaw may meet the one below eye at rear of interopercle. Interspaces between these reddish bands light greenish yellow. The dark blotch in pectoral fin is purplish black.

Remarks.—Doubt may be cast by ichthyologists on my identification of some of the specimens as belonging to this species especially those between 23 and 50 mm. in length with a dark lateral streak and dark caudal-fin spot. Comparison in regard to color pattern with numerous specimens in intermediate stages of this and other species revealed that the adult color pattern of *lutescens* is reached after 50 mm. in length is attained. The specimens thus identified as juvenile were compared with specimens of species of which the juvenile color pattern is known, and which were collected in the Marshall

Islands. By this means the following species were eliminated: *amblycephalus, hardwickei, umbrostygma,* and *quinquevittata.* The single specimen of *lunare* has ii,13 pectoral rays, 6 rakers on upper part of first gill arch whereas the young of *lutescens* with a black lateral streak have ii,14 or 15 pectoral rays and 8 rakers on upper part of first gill arch. Of the three species left as possibilities in the Marshall Islands fauna, *lutescens, fuscum,* and *purpureum,* the juvenile color patterns of the last two have not, to my knowledge, been connected with the adults.

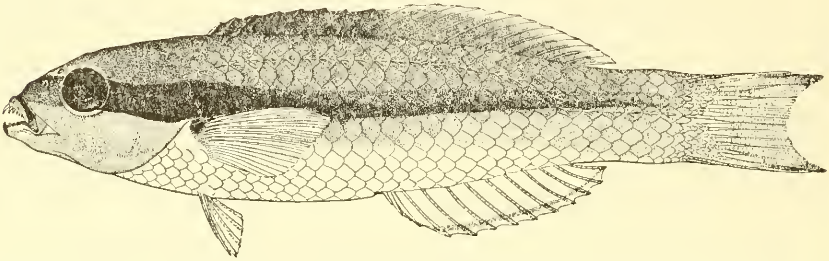

FIGURE 101.—Young of *Thalassoma amblycephalus* (=*marnae*), holotype, USNM 115563, from Hull Island. Drawn by A. M. Awl.

THALASSOMA AMBLYCEPHALUS (Bleeker)

FIGURES 100,*e*, 101; PLATE 91,C

Julis amblycephalus BLEEKER, Nat. Tijdschr. Nederl.-Indië, vol. 11, p. 83, 1856 (type locality, Java; Celebes); Atlas ichthyologique, vol. 1, p. 90, pl. 33, fig. 6, 1862 (Java; Celebes)

Julis melanochir BLEEKER, Act. Soc. Sci. Indo-Néerl. vol. 2, p. 77, 1857 (type locality, Amboina); Atlas ichthyologique, vol. 1, p. 89, pl. 33, fig. 2, 1862 (Amboina)

Thalassoma marnae SCHULTZ, U. S. Nat. Mus. Bull. 180, p. 203, fig. 17, 1943 (type locality, Phoenix and Samoan Islands, holotype USNM 115563; young).

SPECIMENS STUDIED

Bikini Atoll: 2 stations, 5 specimens, 26 to 54 mm. in standard length.
Rongerik Atoll: 1 station, 1 specimen, 44 mm.
Kwajalein Atoll: 1 station, 16 specimens, 27 to 54 mm.

Description.—Certain counts are recorded in table 101. The following description is based on the young, since no adults of this species were captured in the area under study.

Head 3.2 to 3.4; greatest depth 3.9 to 4.1; longest pectoral ray 5.0 to 5.3; snout tip to anus 1.9 to 2.0; snout to dorsal origin 3.2 to 3.4; all in standard length. Snout 3.8 to 4.5; eye 3.8 to 4.0; postorbital length of head 1.8 to 1.9; interorbital space 3.3 to 4.0; longest pectoral ray 1.4 to 1.6; least depth of body 2.1 to 2.2; all in length of head. Distance between anterior and posterior nasal openings 2.5 to 2.8 in snout. Eye 0.8 to 1.0 in interorbital space.

Pectoral fin reaches opposite ninth lateral line scale; pelvics reach not quite halfway to anus; distal edge of caudal fin truncate in smallest specimens, concave in larger ones.

Color in alcohol.—White below midlengthwise axis of body, abruptly darker dorsally, with a blackish or dark brown band about as wide as eye from snout tip through eye to base of caudal fin, the lower edge of this blackish band along lateral line on caudal peduncle; another dark streak or band extending from interorbital space along middorsal line thence on each side of base of dorsal fin and fading posteriorly; space between the two blackish streaks light brownish; spinous dorsal and continuing along basal three-fourths of soft dorsal blackish or brownish, marginal quarter white; anal and pelvic fins white; pectorals translucent basally, distally dusky in larger specimens; dorsal base of pectoral with a black spot; caudal fin whitish, except outer rays distally dusky, with outer edge of dusky streak lined with white, middle caudal rays white; inner side of opercle dusky. At a length of about 100 mm. the black blotch in pectoral fin is fully developed.

Color when alive.—Upper sides between black bands olive; ventral part of head and of body yellowish to orange; a silvery band just below lateral black band extends from head to tip of caudal fin grading into the yellow-orange ventrally; anal fin rose-colored; upper and lower rays of caudal fin rose-colored. (Description based on Phoenix Island specimens.)

Remarks.—In this genus the species *amblycephalus* (Bleeker), *duperry* (Quoy and Gaimard), and *lucasanum* (Gill) form a group, the young of which have a blackish lateral band and a narrower dark streak along the back, the space between light dusky, and the ventral area whitish. In the adult coloration the black bands or streaks disappear. Most adults have in the pectoral fin a blackish streak that is characteristic of this group (see fig. 100).

Bleeker's *amblycephalus* was based on specimens 42 to 90 mm. long and it has a narrow white line across the operculum; upper half of body is dark, sharply contrasting with pale ventral half; it represents the half-grown stage. His *melanochir* is the adult stage, and has 2 pale marks across side of head. We have specimens showing this transition.

In the tabulation of color characteristics below, *T. duperry* and *T. lucasanum* are easily distinguished by the difference in coloration of the head and of the median fins. Also, *lucasanum* and *amblycephalus* have 13 branched pectoral rays (rarely 12), whereas *duperry* has 14 (rarely 13 or 15); and 16 to 19 gill rakers on the first gill arch, whereas *duperry* has 20 to 22.

	duperry	*lucasanum*
Head	Plain dark brown	Plain dark brown.
Broad pale bar behind head.	Present, sometimes indistinct.	Present, sometimes indistinct.
Dorsal base of pectoral fin.	Black spot present	Black spot present.
Inner ventral part of pectoral fin base.	Brownish	Pale.
Dorsal edge of pectoral fin basally.	Pale	Blackish line.
Dorsal fin	Plain dark brown, distal edge same color as fin.	Usually brownish and darker than body, distal edge white, especially along soft dorsal fin.
Anal fin	Plain dark brown, distal edge of same color as fin.	Darker than body, usually brownish, distal edge white.
Distal edge of caudal fin of adult.	Brown	Whitish.
Tips of outer rays of caudal fin.	Same color as rest of fin.	Brownish streak with whitish line dorsally and ventrally.

Thus far all the specimens of *duperry* examined by us were from the Hawaiian Islands or from Johnston Island. We cast doubt on the accuracy of identification of specimens from other localities such as the Philippines (Fowler and Bean, U. S. Nat. Mus. Bull. 100, vol. 7, p. 392, 1928). Records for the occurrence of *duperry* in the American tropical Pacific are for *lucasanum*.

THALASSOMA QUINQUEVITTATA (Lay and Bennett)

PLATE 99,A

Scarus quinquevittatus LAY and BENNETT, Fishes, *in* Zoology of Captain Beechey's voyage . . ., p. 66, pl. 19, fig. 3, 1839 (type locality, Loo Choo Islands).

Julis guntheri BLEEKER, Verslag. Akad. Wet. Amsterdam, vol. 13, p. 279, 1862 (Manado); Atlas ichthyologique . . ., vol. 1, p. 94, pl. 34, fig. 1, 1862 (Celebes and Sangi).

Thalassoma albolineum NICHOLS, Amer. Mus. Nov. No. 1154, p. 1, fig. 6, 1941 (type locality, Bali).

Halichoeres leparensis SEALE, Occ. Pap. Bishop Mus., vol. 1, no. 3, p. 89, 1901 (type locality, Guam).

SPECIMENS STUDIED

Bikini Atoll: 31 stations, 653 specimens, 13 to 125 mm. in standard length.
Eniwetok Atoll: 8 stations, 124 specimens, 13 to 105 mm.
Rongerik Atoll: 5 stations, 139 specimens, 21 to 95 mm.
Rongelap Atoll: 9 stations, 156 specimens, 20 to 106 mm.
Kwajalein Atoll: 2 stations, 52 specimens, 19 to 108 mm.
Likiep Atoll: 1 lot, Univ. Washington, 1 specimen, 60 mm.
Guam: 1 lot, 7 specimens, 14 to 30 mm.
Saipan: 1 lot, 4 specimens, 61 to 94 mm.

Description.—Head 3.0 to 3.4; greatest depth 3.3 to 3.5; longest pectoral ray 4.4 to 4.8; snout tip to anus 1.7 to 1.8; snout to dorsal origin 2.7 to 3.0; all in standard length. Snout 3.2 to 3.4; eye 4.1 to 5.8; postorbital length of head 1.9 to 2.0; interorbital space 4.0 to 4.7; longest pectoral ray (second branched) 1.4 to 1.8; all in length of head. Distance between anterior and posterior nasal openings 4.0 to 4.6 in snout. Eye 0.8 to 1.6 in interorbital space.

Dorsal profile of head evenly convex, forming an angle of about 60 to 70 degrees with ventral contour of head; pectoral fin reaches to opposite about eleventh lateral line pore; pelvics reach two-thirds of the way to the anus; distal edge of caudal fin rounded in the young, truncate in half-grown, and concave in adults.

Color in alcohol.—Background coloration light olive to dark brown or blackish with two pale lengthwise streaks on sides. The dark adult color pattern is usually distinct at standard lengths of 50 mm. and longer. It consists of a grayish-white streak along upper sides and another along midlengthwise axis of body, bordered above and below by blackish streaks; lower part of body paler. The dark streak between the two white or pale ones is widest and meets its fellow at middorsal line of nape. The dark streaks above and below the median white streak on sides are broken into black oblong blotches, one for each scale. Dorsal posterior part of pectoral fin is dusky, the basal part clear. Radiating from eye are six dusky to blackish streaks: One from dorsal edge of eye, meeting its fellow at middorsal line; one from front of eye, meeting its fellow on middle of snout; one to rear of preorbital just in front of corner of mouth; two from a common origin at lower edge of eye, the first to under side of head and the second posteriorly to opposite lower front part of pectoral base; and one from rear of eye, curving toward dorsal edge of pectoral fin base. Lips and chin whitish; pelvic and anal fins pale or white; caudal fin pale or white in central portion but dusky basally and both dorsal and ventral edges are dusky. Dark spot near tip of snout is present in most of the smaller, lighter colored specimens; dorsal edge of pectoral base with blackish area; dorsal fin with black blotch between first to third spines; soft dorsal fin with dark spot between second and third rays; at base of each dorsal fin ray, between length of 30 to 70 mm., occurs a dark spot, which frequently is lacking on base of fifth and ninth soft rays. At standard lengths from 14 to about 35 mm. only three dark spots are prominent on dorsal fin, the dark spots at base of rays are absent or indistinct, one spot occurs between first and third spines, one between second and fourth soft ray; and one at base of last soft ray; also a black dot occurs just dorsal to midline at base of caudal fin.

Color when alive.—Background coloration dark green, becoming yellowish green ventrally; anal yellowish green; sides behind head with two red bands, dorsal one about as wide as eye extends from region of nape above lateral line to dorsal edge of caudal peduncle and thence along dorsal edge of caudal fin to its tip, the other red streak begins behind head a little above base of pectoral fin and continues straight to midbase of caudal fin; these red bands connected by nearly vertical narrow red lines, one on each scale, usually lacking on caudal peduncle; ventral edge of caudal peduncle dark red; breast and belly dark olive green; an oblique red streak occurs just in front of pectoral base and another one parallel to it a little behind and below pectoral base, neither of these red streaks reaches to the midventral line. The white or pale (in alcohol) streaks that radiate from eye are dark red, and the brown (in alcohol) streaks are olive green. Posteroventral part of head violet. Front of dorsal fin with a bright purple spot, blackish in alcohol; base of dorsal fin with a bright red or scarlet band, distal half of dorsal fin bright yellow. Caudal fin translucent pinkish yellow; pectoral and pelvics hyaline. A kodachrome picture shows the dorsal fin as pinkish orange without the red and yellow bands.

Ecology.—This is one of the most abundant species of fishes taken on the reefs in the northern Marshall Islands. It occurred in nearly all kinds of habitats where there were corals and algae, with crevices for protection. It was taken in the lagoon at depths of about 30 to 40 feet.

Remarks.—A small species of reef fish, *T. quinquevittata* seldom grows to a size of over 120 mm. in standard length. Only a few of our specimens exceed 100 mm.

THALASSOMA FUSCUM (Lacepède)

PLATE 107, C

Labrus fuscus LACEPÈDE, Histoire naturelle des poissons, vol. 3, pp. 437, 493, pl. 4, ? fig. 1, 1802 (type locality, "great equatorial ocean").

Labrus trilobatus LACEPÈDE, Histoire naturelle des poissons, vol. 3, pp. 454, 526, 1802.

SPECIMENS STUDIED

Bikini Atoll: Boby Island, August 17, 1946, S–46–383, 1 specimen, 122 mm.
Marianas Islands: Rota Island, 1945, 1 specimen, 205 mm.

Description.—Certain counts are recorded in table 101. Head 3.1 to 3.3; greatest depth 2.4 to 3.0; longest pectoral ray 4.4 to 4.6; snout tip to anus 1.7 to 1.8; snout to dorsal origin 2.8 to 2.9; all in standard length. Snout 2.5 to 2.6; eye 6 to 8; postorbital length of head 1.7 to 1.8; interorbital space 4.2 to 3.5; longest pectoral ray 1.3 to 1.4; all in length of head. Distance between anterior and posterior nasal openings 5 to 7.5 in snout. Eye 1.5 to 3.0 in interorbital space.

Dorsal profile convex, forming an angle of 75 to 80 degrees with ventral contour of head; pectoral fin reaches to opposite ninth or tenth lateral line scale; pelvics reach about two-thirds the way to anus; caudal fin truncate to convex in adults.

Color in alcohol.—Background coloration light brown to brownish; two brownish bands, one along back, composed of blotches, the other on middle of side, extending from above pectoral fin base to caudal peduncle just above peduncular lateral line, these composed of vertically oblong brown blotches with dark brown edges, each blotch is separated by a narrow pale vertical interspace, and the two bands separated by a light band crossed with the vertically pale lines. Basal half of dorsal and anal fins brown, distal half white; a dark spot between first to third dorsal spines; dorsal edge of pectoral base black; pectoral dusky to dark brownish dorsally and distally; pelvics pale; operculum and branchiostegal membranes along posterior edges white.

Color when alive.—A Phoenix Island specimen had the head orange, upper lips blue, chin light blue; two blue spots over eye and one below it; operculum margined with blue; pectoral base blue, axil blue; pelvic fin blue and green; basal half of dorsal and of anal fins with an orange band, distally these fins are green, except for a series of orange spots, one between each ray on the membranes; upper and lower caudal rays and distal part of fin blue; along midlengthwise axis of body an orange band, another on lower sides at about level of ventral edge of pectoral base; back with row of oblong rectangular orange blotches; these orange bands connected with each other by straight orange lines, the oblong rectangular interspaces bright green.

THALASSOMA PURPUREUM (Forskål)

PLATE 100,D

Scarus purpureus FORSKÅL, Descriptiones animalium . . ., pp. x, 27, 1775 (type locality, Djedda, Red Sea).

Julis purpurea PELLEGRIN, Bull. Mus. Hist. Nat. Paris, No. 4, p. 228, 1898 (Rota, Marianas).—SEALE, Occ. Pap. Bishop Mus., vol. 1, No. 3, p. 91, 1900 (Agana, Guam).

SPECIMENS STUDIED

Bikini Atoll: 3 stations, 4 specimens, 190 to 246 mm.; 1 lot, Univ. Washington, 1 specimen, 195 mm.

Rongerik Atoll: 1 station, 1 specimen, 190 mm.

Guam: 1 lot, 1 specimen, 245 mm.

Description.—Certain counts are recorded in table 101.

Head 2.8 to 2.9; greatest depth 3.0 to 3.2; longest pectoral ray 4.6 to 5.0; snout tip to anus 1.6 to 1.7; snout to dorsal origin 2.6 to 2.7; all in standard length. Snout 2.6 to 2.7; eye 7 to 8; postorbital length of head 1.7 to 1.9; interorbital space 4.2 to 4.4; longest pectoral ray 1.6 to 1.7; least depth of body 2.1 to 2.4; all in length of head. Distance between anterior and posterior nasal openings 6 to 7 in snout. Eye 1.9 to 2.1 in interorbital space.

Dorsal profile of head convex, forming an angle of 80 to 85 degrees with ventral contour of head; pectoral fin reaches opposite ninth or tenth lateral line scale; pelvics reach half way to three-fourths the way to anus; distal edge of caudal fin double concave, the median rays convex, or concave, with outer rays elongate on large adults.

Color in alcohol.—Background coloration light brownish or olive with a dusky or brownish band (reddish when alive) on back; sides with two pale or whitish bands (reddish when alive). The dorsal one extends from just above pectoral fin base posteriorly to caudal peduncle, where it lies just above lateral line; the lower one extends from ventral edge of pectoral fin base to lower side of caudal peduncle; the two dorsal streaks are connected by pale or dusky narrow streaks; a characteristic pale band extends from rear of orbit obliquely downward across operculum, forking posteriorly and thence continuing on breast under pectoral fin base as a band; dorsal edge of pectoral base blackish, mostly on posterior side; dorsal edge of pectoral fin dusky; both dorsal and anal fins have a pale streak basally, whereas the distal half of these fins is light dusky or greenish; the smallest specimen listed has a dusky or greenish streak in middle of dorsal and anal fins and basally and distally the fins are pale or whitish (red when alive); caudal, pectoral, and pelvics pale.

Color when alive.—Background coloration bright green, pale bands on sides red, dorsal pale or dusky band purplish red; pale streaks on head reddish, rest of head bright green, lips green; front of snout reddish with a green streak across snout just above lips; basal pale streak on dorsal and anal fins red, rest of fin green; pectoral pelvics and caudal fins green; the dorsal and ventral red or orange bands on body continue on caudal fin just inside the greenish outer edges; eye pinkish.

Remarks.—This species is represented by specimens of moderate size but no small ones were found as is usual in collecting fishes. Because of this, authors have tried to identify *T. purpureum* with other related species.

I have compared *T. purpureum* between the standard lengths of 190 to 246 mm. with a series of *T. trilobata* (Lacepède) between 108 and 225 mm., and with a series of *T. umbrostygma* between 14 and 275 mm., I find no overlapping of the details of the color pattern.

Genus GOMPHOSUS Lacepède

Gomphosus Lacepède, Histoire naturelle des poissons, vol. 3, p. 100, 1802 (type species, *Gomphosus caeruleus* Lacepède).

Gomphosis Swainson, Natural history and classification of fishes . . ., vol. 2, pp. 43, 173, 231, 1839 (amended spelling after Lacepède).

Acarauna Sewastianoff, Acta Acad. Sci. Imp. Petrop. (1796), p. 357, 1802 (type species, *Acarauna longirostris* Sewastianoff=*Gomphosus caeruleus* Lacepède). Ref. copied.

Elops (Commerson) Lacepède, Histoire naturelle de poissons, vol. 3, p. 100, 1802 (type species, *Gomphosus caeruleus* Lacepède).

KEY TO THE SPECIES OF GOMPHOSUS

1*a*. Pectoral rays ii,13; no dark spots on scales; dorsal and anal fins white, without spots; outer rays of caudal fin elongate, brown to tips, sharply contrasting with the white central area, which covers two-thirds of the middle rays of the caudal fin; pectoral fin with narrow white edge distally then a broad dusky band, the basal half a little paler; no dark streak behind eye. (Mauritius.)------------------**G. caeruleus**[49] Lacepède

1*b*. Pectoral rays ii,14; a vertical elongate dark spot on each scale.

  2*a*. Pectoral fin plain pale and no median dusky cross band; anterior part of body whitish or pale, especially lower and under side of head, posterior part of body dark brown or blackish; dorsal and anal fins blackish with round white spots, distal edges of both fins white; posterior distal third of caudal fin white, outer caudal fin rays with distal fourth white, not brown or blackish; no white blotch above base of pectoral fin; usually two dark streaks behind eye, these separated by pale area------------------------**G. varius** Lacepède

  2*b*. Pectoral fin with a broad dusky band across middle, basal third and distal thirds notably paler; anterior and posterior parts of body and head of about same dark intensity, underside of head not notably pale; outer caudal fin rays dark brown or blackish to tips of rays; middle caudal fin rays with distal half white, basal half dark brown; usually a large white blotch on side above base of pectoral fin; no dark streaks behind eye.

    3*a*. Dorsal and anal fins white----------**G. tricolor** Quoy and Gaimard

    3*b*. Dorsal and anal fins dark brown or blackish with a row of white spots mesially; distal edge of both dorsal and anal fins narrowly edged with white--------------------------**G. undulatus**[50] Streets

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[49] Description based on 2 specimens from Mauritius, USNM 19970 and 130977.

[50] *Gomphosus undulatus* Streets, U. S. Nat. Mus. Bull. 7, p. 85, 1877 (Fanning Islands, holotype USNM 19230).

The holotype of *undulatus* differs from all the other specimens referred to *tricolor*, *varius*, and *caeruleus* that I have examined, as indicated in the key. The color pattern of *undulatus* is closest to *tricolor*. I have compared *undulatus* with 13 specimens of *tricolor* from the Hawaiian Islands, 1 from Tahiti, 1 from Johnston Island, 2 from Samoa, 1 from the Pacific Ocean, 15 from the Northern Marshall Islands, and 1 from the Philippines; I find none of these have dark soft dorsal and anal fins with a row of white spots, and therefore conclude that *G. undulatus* should be recognized at least tentatively as a valid species. The final opinion on this species must await the collection of a larger series of *undulatus* for use in determining the variability in color pattern. Scarcely any variation in the color pattern of the median fins of *tricolor* was observed in the material examined by me.

GOMPHOSUS VARIUS Lacepède

PLATE 100,B

Gomphosus varius LACEPÈDE, Histoire naturelle des poissons, vol. 3, pp. 100, 104, pl. 5, fig. 2, 1802 (type locality, Tahiti).

SPECIMENS STUDIED

Bikini Atoll: 21 stations, 85 specimens, 23 to 149 mm. in standard length.
Eniwetok Atoll: 2 stations, 6 specimens, 41 to 113 mm.
Rongelap Atoll: 8 stations, 25 specimens, 23 to 117 mm.
Rongerik Atoll: 3 stations, 5 specimens, 42 to 91 mm.
Kwajalein Atoll: 1 station, 1 specimen, 38 mm.
Guam. 1 lot, 2 specimens, 29 & 74 mm.

Description.—Dorsal rays VIII,13; anal III,11 rarely III,10; pectoral ii,14; pelvics I,5; branched caudal fin rays 6+6; scales in lateral line 19 or 20+1+5, with about 3 or 4 scales above lateral line to base of last dorsal spine and 8 or 9 scales from anal origin to lateral line; gill rakers about 23 to 25.

Head 2.3 to 2.7, greatest depth 3.6 to 3.8, longest pectoral fin ray 4.9 to 5.3, snout tip to anus 1.6 to 1.7, snout to dorsal origin 2.2 to 2.5; all in standard length. Snout 1.7 in adults and 2.5 in young; eye 4.2 to 8.5, postorbital length of head 2.3 to 3.0, interorbital space 5.0 to 7.5, longest pectoral fin ray 2.0 to 2.3, least depth of body 2.3 to 3.2; all in length of head. Distance between anterior and posterior nasal openings 4 to 12 in snout. Eye 0.8 to 1.3 in interorbital space.

Body a little compressed, snout excessively elongate, tubiform, much shorter in young, becoming longer in adults, dorsal profile of head and snout a little concave; interorbital space convex; anterior nostril a short tube; upper jaw a little longer than lower; mouth reaching about halfway to eye; teeth in a single series in both jaws, anterior 2 or 3 pairs in both jaws enlarged, middle pair of upper jaw larger than others and hooked, lower middle pair pointing obliquely forward; gill membranes joined to isthmus; subopercle with a free lower edge; posteriorly preopercle with a free vertical edge; head naked; body scaled, these extending on base of caudal fin but lacking on paired fins, basally a sheath of scales occurs on dorsal and anteriorly on anal fins; lateral line follows dorsal contour with an abrupt bend to midlengthwise axis opposite rear of base of dorsal fin; pectoral fin reaches to opposite tenth or eleventh lateral line scale; pelvics reach about ⅔ way to anus.

Color in alcohol.—Adults, 45 mm. and longer have pale or white background coloration anteriorly, becoming dark brown posteriorly; each scale near its center with black spot (on specimens 130 mm. and longer these spots become vertically elongate); posterior third of caudal fin white; a streak through middle of eye sometimes broken into two rows of oblong spots behind eye; black spot at upper base of pectoral fin; distal edge of anal fin white, then submarginally black, then through middle of fin a white streak, forming round white spots posteriorly or white spots along entire length of fin; base of anal black; tips of soft dorsal rays white, remainder of fin dark brown; paired fins pale; peritoneum pale to light dusky.

Young, standard lengths of 29 to 35 mm., are pale anteriorly, brown posteriorly with 2 blackish lateral streaks, one from snout through eye, thence to caudal peduncle a little above midlengthwise axis; second from lower side of mouth across lower edge of cheek, thence just below pectoral base along lower lateral side and ending on caudal peduncle. Young, standard lengths 23 to 32 mm., have two black lateral streaks as above but background color white; base of caudal fin with one or two black spots.

Color when alive.—Anteriorly pale pinkish orange, tinged with iridescent; posteriorly purplish black; pectoral fin slightly yellowish, pale posterior band on caudal fin pale yellowish; outer edges of soft anal and dorsal rays white; upper half of snout rich brown, fading into pale brown over eyes; the roundish pale area on anal fin near middle of rays, lemon yellow; spiny dorsal orange-brown, with a pale green area of spots, rather faint at base of rays on body.

Ecology.—This common gomphosid occurred among the coral and algal growths in shallow as well as in deep water. At no time, however, were any large series taken; instead, specimens were taken singly or only a few in any one place.

Remarks.—*Gomphosus undulatus* Streets, USNM 19230, is not a synonym of *G. varius*, as stated by Fowler and Bean 1928 (see footnote 50), but is a valid species.

GOMPHOSUS TRICOLOR Quoy and Gaimard

PLATE 100,A

Gomphosus tricolor QUOY and GAIMARD, Voyage autour du monde . . . sur . . . l'*Uranie* et la *Physicienne*, Zoologie, p. 280, pl. 55, fig. 2, 1824 (type locality, Hawaiian Islands).

Gomphosus pacificus SEALE, Occ. Pap. Bishop Mus., vol. 1, No. 3, p. 94, 1900 (type locality, Guam).

SPECIMENS STUDIED

Bikini Atoll: 8 stations, 9 specimens, 111 to 193 mm. in standard length.
Rongelap Atoll: 1 station, 1 specimen, 122 mm.
Eniwetok Atoll: 1 station, 1 specimen, 152 mm.
Rongerik Atoll: 2 stations, 5 specimens, 108 to 141 mm.

Description.—Dorsal rays VIII,13; rarely VIII,12; anal III,11; pectoral ii,14; pelvics I,5; branched caudal fin rays 6+6; scales in lateral line 26 or 27, with 3 or 4 scales above lateral line to base of last dorsal spine and 9 or 10 scales from anal origin to lateral line; gill rakers about 23 to 26 on first gill arch.

Head 2.2 to 2.5; greatest depth 3.5 to 3.8; longest pectoral fin ray 5.1 to 5.6; snout tip to anus 1.6 to 1.7; snout to dorsal origin 2.1 and 2.2; all in standard length. Snout 1.7 to 2.0 (in adults); eye 7 to 11; postorbital length of head 2.5 to 2.9; interorbital space (bony) 0.8 to 7.5; longest pectoral fin ray 2.3 to 2.5; least depth of body 3.4 to 3.7; all in head length. Distance between anterior and posterior nasal openings 10 to 12 in snout. Eye 1.0 to 1.6 in interorbital space.

Body a little compressed, snout excessively elongate, tubiform, shorter in smaller specimens than in large adults; dorsal profile of head and snout a little concave; interorbital space strongly convex; anterior nostrils a short tube; upper jaw a little longer than lower; mouth reaching about halfway to eye; teeth in a single row in both jaws, anterior 2 or 3 pairs in both jaws enlarged, middle pair of upper jaw a little hooked, those of lower jaw pointing forward and with curved tips, gill membranes joined to isthmus; subopercle with a free lower edge; posterior vertical edge of preopercle free; head naked; body scaled; base of caudal fin scaled, other fins naked except low sheath of scales along bases of dorsal and anal fins; lateral line follows dorsal contour with an abrupt bend to midaxis opposite rear base of dorsal fin; pectoral fin reaches to opposite tenth or eleventh lateral line scale; second branched ray from dorsal edge longest; pelvics reach about ⅔ to ¾ the way to anus.

Color in alcohol.—Background coloration plain dark brown to dark greenish brown or greenish black; anal and dorsal fins white, except color of body may extend very slightly on bases of these fins; caudal fin brownish, dark greenish brown basally this color extending on outer edges of fin to rear tips of outer rays, central area of fin in posterior half white; sharply contrasting with dark color, the latter having a strongly concave edge; pectorals and pelvics dusky, pectoral with a darker diffuse wide band across middle of length, basal third paler than distal part; dorsal edge of pectoral base with a black spot; peritoneum pale to light dusky; above pectoral fin base a pale area that may extend above lateral line nearly to just in front of dorsal fin origin, this pale area variously developed, scarcely visible at lengths of 100 to 150 mm. and becoming very light at about 200 mm. in standard length.

Color when alive.—Background color dark green or dark greenish blue with center of each scale purple; pale area over pectoral fin light green; posterior part of caudal fin green; basal pectoral fin dusky green, then basal half purplish black, with a pale blue band across the middle, then distal third light dusky; soft dorsal and anal fins green.

Ecology.—This reef inhabiting species was seldom seen and was never taken in abundance; the smallest specimen collected was 108 mm., the young were not seen.

Genus MACROPHARYNGODON Bleeker

Macropharyngodon Bleeker, Proc. Zool. Soc. London, 1861, p. 412 (type species, *Julis geoffroy* Quoy and Gaimard).

The following characters are useful in recognizing this genus: Branched caudal rays 6 + 6; lateral line pores to base of caudal fin 20 + 2 + 5 totaling 27, with 3 rows above lateral line to base of first soft dorsal ray and about 10 below to anal origin; dorsal rays normally IX,11; anal III,11; pectoral rays ii,10; and gill rakers about 5 or 6 + 1 + 9 to 11. Body strongly compressed; snout normal; dorsal profile of head convex; interorbital space convex; jaws terminal, equal or nearly so; teeth short, conical, on sides of jaws, uniserial in lower jaw, biserial anteriorly on upper jaw; anterior teeth canines, middle pair in both jaws pointing obliquely forward, next outer pair in upper jaw widely spaced from middle pair and curved downward and hooked backward a little; next outer pair of lower jaw, widely spaced from middle pair, and pointing forward with a slight curve upward; corner of mouth with a strong canine tooth; middle pair of canines in upper jaw fitting between outer pair in lower jaw when mouth is closed; preopercular margin free posteriorly and only a little distance ventrally. Gill membranes attached to isthmus with a narrow free fold across it.

The numerous specimens of *M. meleagris*, when compared with specimens of *M. geoffroyi* (Quoy and Gaimard) from the Hawaiian Islands, indicates without doubt that it is a species distinct from *M. meleagris* of the western and equatorial Pacific, with which it has been confused by Fowler (Mem. Bishop Mus., vol. 10, p. 344, 1928).

Counts are recorded in table 102 for the species of *Macropharyngodon*.

KEY TO THE SPECIES OF MACROPHARYNGODON

1*a*. Background coloration light olive or pale, everywhere profusely blackish spotted, the pale interspaces scarcely as wide as the spots; these blackish spots variable but smaller than eye and usually larger than pupil; membrane base of each ray of dorsal and anal fins with black blotch; pectoral base with a dark spot; anterior part of isthmus with a black ocellate spot, except in young---------------------- **M. pardalis** (Kner)

1*b*. Background coloration brownish, light brownish, or light tan, each scale with a round pale spot bordered with brownish or each scale with a blue spot bordered with brownish; head with brownish streaks instead of dark spots.

  2*a*. The brown streaks on head as wide as or wider than the paler interspaces; a dark blotch a little behind head, at level of upper edge of gill opening, sometimes with a bright silvery center.
  M. meleagris (Cuvier and Valenciennes)

  2*b*. The brown (blue when alive) streaks on head narrower than pupil, very notably twice or more times narrower than pale interspaces; no black ocellate spot at front of isthmus; no dark shoulder spot. (Hawaiian Islands.)-------------------- **M. geoffroyi** (Quoy and Gaimard)

Table 102.—*Counts recorded for species of* Macropharyngodon

Species	Fin rays								Pores in lateral line to base of caudal fin		
	Dorsal		Anal			Pectoral					
	IX	11	III	11	12	ii	10	11	20	+2	+5
pardalis	7	7	7	7	------	13	13	------	6	6	6
meleagris	9	9	10	9	1	20	19	1	10	10	10
geoffroyi	2	2	2	2	------	4	4	------	2	2	2

MACROPHARYNGODON PARDALIS (Kner)

Plate 100,F

Leptojulis pardalis Kner, Sitzb. Akad. Wiss. Wien, vol. 56, p. 728, pl. 3, fig. 2, 1867 (type locality, Viti Island, Fiji).

Platyglossus nigromaculatus Günther, Proc. Zool. Soc. London, 1871, p. 666, pl. 65, fig. B, (type locality, Savay, Samoa).

Halichoeres nigropunctatus Seale, Occ. Pap. Bishop Mus., vol. 1, No. 3, p. 89, 1901 (type locality, Guam).

SPECIMENS STUDIED

Bikini Atoll: 13 stations, 38 specimens, 27 to 96 mm. in standard length.
Rongerik Atoll: 1 station, 1 specimen, 45 mm.
Eniwetok Atoll: 2 stations, 7 specimens, 40 to 74 mm.
Rongelap Atoll: 7 stations, 32 specimens, 30 to 98 mm.

Description.—Head 2.5 to 3.1; greatest depth 2.5 to 3.1; longest pectoral ray 3.8 to 4.8; snout tip to anus 1.9 to 2.0; all in standard length. Snout 2.8 to 3.8; eye 3.5 to 5.6; postorbital length of head 1.9; interorbital space 3.3 to 4.4; longest pectoral ray 1.5; least depth of body 1.9 to 2.1; all in length of head. Eye in fleshy interorbital space 0.9 to 1.6.

Dorsal profile of head forming an angle of about 70 to 75 degrees with ventral contour of head; pectoral fin reaches to opposite about tenth or eleventh lateral line pores; outer pelvic rays elongate, reaching to anus, longest ray about equal to postorbital length of head; distal margin of caudal fin a little rounded.

Color in alcohol.—Background coloration light tan or light yellowish; head, body and median fins everywhere with blackish round to oblong or squarish spots, the pale interspaces usually narrower than the dark spots; the latter usually a little smaller than eye, except on the fins the spots are about the size of the pupil; pelvics with black spots; lower base of pectoral fin with a dark spot; anterior part of isthmus with a black ocellate spot the size of eye; membranes between subopercle usually pale, occasionally dusky; dorsal and caudal fins barred; pectorals plain pale; peritoneum black.

Our smallest specimen, 27 mm., is dark spotted like the larger adults, except that dark spots are lacking on caudal and dorsal fin and front of head; the dark spots on mid-sides are more W-shaped, fewer in number but larger, posteriorly the spots are smaller than pupil; the posterior rays of soft dorsal has a black spot, and a series of black spots occur basally in the anal fin. On the 30 mm. specimen, a black spot has formed at the base of the membrane in front of each dorsal fin ray, so characteristic for the adults.

Color when alive.—Background coloration olive, dark spots blackish or dark brown edged with light blue; dorsal and caudal fins barred with yellowish and brownish red; and barred distally with yellowish and brownish red; basally the anal is spotted like the body; lips pinkish.

Ecology.—This labrid was an abundant species in the tidal area of the atolls and in the lagoon in water as deep as 30 feet.

Remarks.—Fowler in his various writings places this species in the genus *Leptojulis.* Weber and De Beaufort place *Leptojulis* as a subgenus of *Halichoeres.* They also place *M. pardalis* in the genus *Macropharyngodon,* with which opinion I fully agree.

MACROPHARYNGODON MELEAGRIS (Cuvier and Valenciennes)

PLATE 100,C

Julis meleagris CUVIER and VALENCIENNES, Histoire naturelle des poissons, vol. 13, p. 481, 1839 (type locality, Ulea).

SPECIMENS STUDIED

Bikini Atoll: 8 stations, 17 specimens, 71 to 121 mm. in standard length.
Rongelap Atoll: 3 stations, 7 specimens, 85 to 118 mm.
Eniwetok Atoll: 1 station, 3 specimens, 90 to 93 mm.

Description.—Head 3.0 to 3.2; greatest depth 2.5 to 2.6; longest pectoral ray 4.7 to 5.0; snout tip to anus 1.9 to 2.1; snout to dorsal origin 3.4 to 3.6; all in standard length. Snout 2.7 to 3.1; eye 4.8 to 6.8; postorbital length of head 1.9; interorbital space 3.4 to 3.5; longest pectoral ray 1.5 to 1.6; least depth of body 1.7 to 1.8; all in length of head. Eye in fleshy interorbital space 1.5 to 2.0.

Dorsal profile of head forming an angle of about 75 to 80 degrees with ventral contour of head; pectoral fin reaches to opposite about the tenth or eleventh lateral line pores; outer pelvic rays longest, reaching to anus, longest ray shorter than head; distal margin of caudal fin a little rounded or truncate.

Color in alcohol.—Background coloration light brownish, each scale with pale center, median fins with brownish-bordered round whitish spots the size of pupil or a little larger; head with round and oblong brown-edged pale areas; isthmus anteriorly with a black ocellate spot, or a black spot; gill membranes between subopercular blackish; a black spot below lateral line about 3 scale rows behind upper edge of gill opening; basal half of first to fourth dorsal spines blackish, distally white; lower half of pectoral base with a blackish bar and dorsal edge brownish basally; pelvic and pectoral fins whitish to translucent; dorsal and ventral edge of caudal fin usually blackish to brownish; on some specimens two or three indistinct vertical bars may occur, first under black area at front of spiny dorsal fin, second as a dusky blotch between base of dorsal soft rays 1 to 4 and on body above lateral line, third at base of and on body below dorsal soft rays 8 to 11. Peritoneum black.

Ecology.—This species occurred in areas of abundant coral and algal growths in the lower part of the tidal zone and in deeper water. It was uncommon at all times.

Genus STETHOJULIS Günther

Stethojulis Günther, Catalogue of the fishes in the British Museum, vol. 4, p. 140, 1862 (type species, *Julis strigiventer* Bennett).

Hinalea Jordan and Jordan, Mem. Carnegie Mus., p. 69, 1923 (type species, *Julis axillaris* Quoy and Gaimard).

Rhytejulis Fowler and Bean, U. S. Nat. Mus., Bull. 100, vol. 7, pp. 232, 241, 1928 (type species, *Labrus trilineatus* Bloch and Schneider).

The species of this genus are relatively constant in regard to the following characters: Snout normal, not elongate; interorbital space convex; nostrils small, anterior with a low raised rim; jaws equal or nearly so; maxillary reaching to a vertical line between nostrils; maxillary concealed by preorbital; premaxillary protractile; first anal spine minute, mostly embedded at base of second; gill membranes joined at side of isthmus without a free fold; teeth scarcely projecting forward at front of jaws and little enlarged; head naked; all fins naked except base of caudal fin is scaled; lateral line continuous.

The median fin rays are nearly constant for each species: Dorsal IX,10 to 14; anal III,10 to 12; branched caudal 6+6; see table 103 for recorded counts.

KEY TO THE SPECIES OF STETHOJULIS

1*a*. Behind the base of the pectoral fin on sides of body and below lateral line, 4 to 6 black blotches or short bars, the last over the first 3 anal rays; on caudal peduncle a brown line above and one below lateral line, parallel with it; base of pectoral not black; pectoral rays ii,11; pores in lateral line 19+2+6 or 7 ________________________ **S. maculatus** [51] Schmidt

1*b*. Color not as in 1*a*.

2*a*. Pectoral rays usually ii,11, occasionally ii,12.

3*a*. Dorsal half of pectoral fin base black; no brown spots on scales of body ventrally; a white streak (1) extending on each side of middorsal line beginning at nape, then along dorsal fin base; another (2) from middle of snout through upper part of eye thence to dorsal edge of gill opening, ending just above white spot dorsal to pectoral fin base; another (4) from just behind head in a straight course below pectoral base and ending near rear ventral edge of pectoral base; these white streaks may be indistinct or obsolete in alcoholic preservation.

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[51] *Stethojulis maculatus* Schmidt, Trans. Pacific Comm. Acad. Sci. USSR, vol. 1, p. 81, pl. 5, fig. 1, 1930 (type locality, Kominata, Riu Kiu Islands).

4*a*. White streak (3) from tip of snout, extending along lower edge of eye to dorsal edge of pectoral base, ending in axil of pectoral and beginning again a little behind a vertical line through anal origin and continuing to base of caudal fin (sometimes there is a white dot or so in the interrupted area), passing just below lateral line pores on caudal peduncle-------------**S. interrupta** [52] (Bleeker)

4*b*. White streak (3) from tip of snout, extending just below eye to dorsal edge of pectoral base, then continuing to base of caudal fin, passing just below lateral line pores on caudal peduncle; the white streaks may be obsolete or indistinct in alcoholic preservation.
S. trossula [53] Jordan and Snyder

3*b*. Pectoral fin base white or pale, not blackish.

5*a*. White streak (1) beginning each side of middorsal line of nape and passing posteriorly along base of dorsal fin; another (2) beginning at middle of snout at middorsal line, passing through upper part of eye, thence through dorsal edge of gill opening posteriorly just below dorsal lateral line pores to base of caudal fin above lateral line on caudal peduncle; another (3) extending from tip of snout just below eye to dorsal edge of pectoral base and then a short distance behind pectoral base, ending opposite about the sixth or seventh lateral line scale; another (4) beginning on underside of lower jaw and extending posteriorly across lower part of cheek thence passing just under ventral edge of pectoral base to base of caudal fin, under peduncular lateral line pores; no brown spots in lower half of body in rows; plate 101, B.
S. trilineata [54] (Bloch and Schneider)

5*b*. Coloration not as in *trilineata*.

6*a*. Pores in lateral line to base of caudal fin rays 19+2+5; dorsal two-thirds of body dark brown, sometimes plain brown, or profusely dotted with small white spots; the coloration ends abruptly at a line from lower edge of eye through pectoral base to caudal fin base somewhat below peduncular lateral line; lower third of sides with a brown spot on each scale forming about 4 rows; a slightly dusky spot observable at midbase of scaled part of caudal fin--------------**S. phekadopleura** [55] (Bleeker)

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[52] *Julis (Halichoeres) interruptus* Bleeker, Nat. Tijdschr. Nederl.-Indië, vol. 2, p. 252, 1851 (type locality, Neira, Banda).

[53] *Stethojulis trossula* Jordan and Snyder, Proc. U. S. Nat. Mus., vol. 24, p. 633, fig. 7, 1902 (type locality, Misaki, Japan).

I have compared the following Philippine *Albatross* specimens with the drawing of *S. trossula* and conclude they represent a species distinct from *S. interrupta:* USNM 102818, 122959 and 4 uncatalogued lots, all totaling 13 specimens. We do not agree with Fowler and Bean that *S. trossula* is a synonym of *S. phekadopleura.*

In the holotype of *trossula* as originally figured, and in 2 specimens before me from the Philippine *Albatross* collections the white streaks are indistinct.

[54] *Labrus trilineatus* Bloch and Schneider, Systema ichthyologiae . . ., p. 253, 1801 (type locality, Coringo, Coromandel).

Stethojulis trilineata Bleeker, Atlas ichthyologique . . ., vol. 1, p. 131, pl. 43, fig. 3, 1862.

Julis sebanus Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 13, p. 474, 1839 (on Seba).

[55] *Julis (Halichoeres) phekadopleura* Bleeker, Verh. Bataviassch Gen., Bali, vol. 22, p. 8, 1849 (type locality, Boleling, North Bali).

Stethojulis phekadopleura Bleeker, Atlas ichthyologique . . ., vol. 1, p. 134, pl. 43, fig. 5, 1862.

Stethojulis filholi Sauvage, Bull. Soc. Philomath., Paris, ser. 7, vol. 4, p. 225, 1879 (type locality, Fiji).

Julis leucostictus (Van Hasselt) Bleeker, Atlas ichthyologique . . ., vol. 1, p. 134, 1862 (on "Van Hasselt, in Mus. Lugd. Bat.").

6*b*. Pores in lateral line 18+2+6; dorsal half of body brownish, ventral half pale; white streak (3) passing from snout tip just below eye across upper edge of pectoral base, thence straight to base of caudal fin; this white streak may be obsolete and replaced by a dark brown streak or black one just behind head and on caudal peduncle; scales with brown dots below lateral streak in area above anal fin forward to pectoral base; belly and breast unspotted-------------------------**S. kalosoma** [56] (Bleeker)

2*b*. Pectoral rays normally ii,12 or ii,13.

7*a*. Pores in lateral line 18+2+6; pectoral rays usually ii,13.

8*a*. White streak (1) beginning on nape each side of middorsal line and passing posteriorly along base of dorsal fin; another (2) beginning on middle of snout and passing to upper part of eye, thence across opercle just below upper edge of gill opening, thence behind head on a slightly slanting course to midbase of caudal fin; another (3) beginning at middle of edge of preorbital, passing just along lower edge of eye to dorsal edge of pectoral base, thence to axil of pectoral ending there; another (4) beginning on middle of cleithrum, curving to just under pectoral base and continuing posteriorly, ending about opposite anus or, opposite 11th to 13th lateral line pore; no alternating white or brown streaks ventrally on body. Adult male; known as *S. renardi* (Bleeker).
S. strigiventer (Bennett)

8*b*. Dorsal half of body light brown; ventral half milky white anteriorly; behind head below pectoral base 5 or 6 silvery streaks alternating with brown streaks------------------**S. strigiventer** (Bennett)

7*b*. Pores in lateral line 19+2+5; pectoral rays usually ii,12.

9*a*. Dorsal half of body brownish, lower sides abruptly paler, often separated by a pale streak; caudal peduncle with 2 to 4 (usually 2) small dark brown or black dots or small spots encircled with white (blue when alive) line----**S. axillaris** (Quoy and Gaimard)

9*b*. White streak (1) beginning at dorsal edge of eye, extending to nape, thence posteriorly along base of dorsal fin; another (2) beginning at middle of snout, then extending to front of eye, reappearing on posterior side of eye and curving dorsally to upper edge of gill opening, thence passing just below lateral line ending opposite about 4th or 5th lateral line scale.

10*a*. White streak (3) beginning at middle of preorbital and passing along ventral edge of eye to just a little above pectoral fin base, curving down a little behind pectoral base then following a straight course to base of caudal fin; another (4) beginning on under side of lower jaw, curving across cheek and downward to lower edge of opercle, thence dorsally on cleithrum to front of pectoral base, beginning again at rear of pectoral base and curving a little downward in a nearly straight course to base of caudal fin; streaks (3) and (4) separated by one row of scales………………**S. albovitta**[57] (Bonnaterre)

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[56] *Julis (Halichoeres) kalosoma* Bleeker, Nat. Tijdschr. Nederl-Indië, vol. 3, p. 289, 1852 (type locality, Amboina and Wahai, Ceram).

Stethojulis terina Jordan and Snyder, Proc. U. S. Nat. Mus., vol. 24, p. 631, fig. 6, 1902 (type locality, Misaki, Wakanoura, Kominoto, Japan).

Stethojulis zatima Jordan and Seale, Proc. U. S. Nat. Mus., vol. 28, p. 788, fig. 7. 1905 (type locality, Negros Island, Philippines).

10*b*. White streak (3) beginning at middle of front edge of preorbital, passing along ventral edge of eye and posteriorly just above pectoral base, thence slanting a little ventrally behind pectoral and ending about opposite the 10th or 11th lateral line scale; another (4) beginning on underside of lower jaw, curving dorsally across cheek, thence ventrally across lower tip of opercle and dorsally along edge of cleithrum, ending at front of pectoral base, commencing again in axil of pectoral, curving a little ventrally, one scale row below streak (3), and continuing straight to base of caudal fin; streaks (3) and (4) are on adjoining rows of scales without a row between them.
S. linearis, new species

TABLE 103.—*Certain counts recorded for various species (except* maculatus) *of* Stethojulis *represented in the U. S. National Museum*

Species	Fin rays													Pores in lateral line to base of caudal fin rays					
	Dorsal				Anal				Pectoral					Dorsal lateral line		Oblique part	Peduncular lateral line		
	IX	10	11	12	III	10	11	12	ii	11	12	13	14	18	19	2	5	6	7
axillaris	15	----	14	1	15	----	15	----	28	1	25	3	----	1	6	7	6	1	----
albovittata	8	----	8	----	8	----	8	----	14	----	12	2	----	----	2	2	2	----	----
linearis	9	----	9	----	9	----	9	----	14	3	10	1	----	----	6	6	6	----	----
strigiventer[1]	28	----	28	----	28	----	28	----	135	----	10	116	9	14	----	14	----	14	----
phekadopleura	11	----	11	----	11	----	10	1	26	26	----	----	----	----	10	10	10	----	----
trilineata	3	----	3	----	3	----	3	----	6	5	1	----	----	1	3	4	3	1	----
maculatus[2]	1	----	1	----	1	----	1	----	1	1	----	----	----	----	1	1	----	----	1
kalosoma	6	1	5	----	6	2	4	----	11	11	----	----	----	6	----	6	----	6	----
trossula	3	----	3	----	3	----	3	----	14	14	----	----	----	5	----	5	----	5	----
interrupta	1	----	1	----	1	----	1	----	1	1	----	----	----	1	----	1	----	1	----

[1] William T. Leapley made 66 of the pectoral ray counts for this species.
[2] Counts made on figure of holotype.

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[57] *Labrus albovittata* Bonnaterre, *in* Encyclopédie méthodique, Tableau encyclopédique des trois règnes de la nature . . . , Ichthyologie, vol. 6, p. 108, pl. 98, fig. 399, 1788 (no locality; on Koelreuter).
Stethojulis albovittata Günther, Fische der Südsee, vol. 2, pt. 7, p. 256, 1881; *ibid.*, vol. 3, pt. 8, pl. 141 fig. B, 1909 (on figure by Garrett).
Julis balteatus Quoy and Gaimard, Voyage autour du monde . . . sur . . . l'*Uranie* et la *Physicienne;* Zoologie, p. 267, pl. 56, fig. 1, 1824 (Hawaiian Islands).

STETHOJULIS STRIGIVENTER (Bennett)

FIGURE 102; PLATE 101,A

Julis strigiventer BENNETT, Proc. Comm. Zool. Soc. London, p. 184, 1832 (type locality, Mauritius).

Stethojulis strigiventer BLEEKER, Atlas ichthyologique . . ., vol. 1, pl. 43, fig. 1, 1862.

Julis (*Halichoeres*) *renardi* BLEEKER, Nat. Tijdschr. Nederl.-Indië, vol. 2, p. 253, 1851 (type locality, Neira, Banda).

Stethojulis renardi BLEEKER, Atlas ichthyologique . . ., vol. 1, p. 132, pl. 43, fig. 2, 1862.

Stethojulis psacas JORDAN and SNYDER, Proc. U. S. Nat. Mus., vol. 24, p. 629, fig. 5, 1902 (type locality, Nafa, Okinawa).

SPECIMENS STUDIED

Rongelap Atoll: 3 stations, 11 specimens, 12 to 49 mm. in standard length.
Wotje Atoll: 1 lot, 1 specimen, 70 mm.
Guam: 9 lots, 103 specimens, 25 to 78 mm.
Saipan: 1 lot, 10 specimens, 23 to 40 mm.

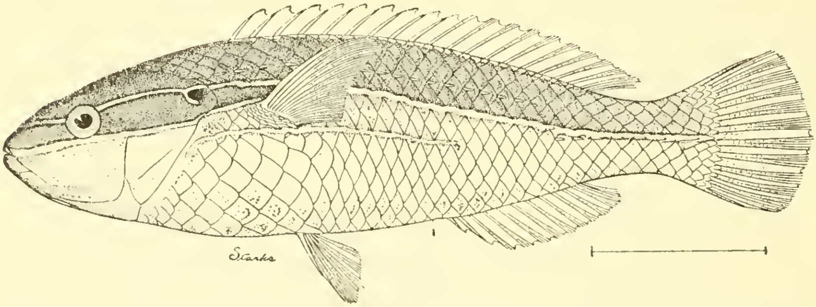

FIGURE 102.—*Stethojulis strigiventer* (Bennett), after holotype of *S. psacas* Jordan and Snyder, adult male.

Description.—Dorsal rays IX,11; anal III,11; pectoral ii,13, rarely ii,12; pelvics I,5; branched caudal rays 6+6; pores in lateral line 19+2+5; 2½ scales above lateral line, and 8½ below to anal origin; vertical scale rows 26 from upper edge of gill opening to base of caudal fin; gill rakers 8 to 11+1+15 to 19.

Head 2.7 to 3.0; greatest depth 3.0 to 3.5; longest pectoral ray 4.2 to 5.0; snout tip to anus 1.6 to 1.7; snout to dorsal origin 2.4 to 2.7; all in standard length. Snout 2.8 to 3.4; eye 3.8 to 5.3; postorbital length of head 2.0 to 2.1; interorbital space 3.6 to 4.8; longest pectoral fin ray 1.6 to 1.8; least depth of body 2.5 to 3.2; all in length of head. Distance between anterior and posterior nasal openings 5.0 to 7 in snout. Eye 1.0 to 1.5 in interorbital space.

Body a little compressed; dorsal profile of head rounded, forming an angle of about 50 to 55 degrees with ventral contour of head; canine tooth at corner of mouth small but distinct; teeth uniserial, compressed, incisorlike, short, about 5 to 7 on each side in upper jaw and 6 to 9 on each side of lower jaw; none of anterior teeth notably enlarged; pectoral reaches to opposite of about 11th lateral line scale; pelvics reach ⅔ the way to anus; caudal fin rounded.

Color in alcohol.—Dorsal half of body light brown, ventral half paler, milky white anteriorly, 5 or 6 silvery streaks separated by brownish streaks behind head and below base of pectoral fin in lower part of body, sometimes each scale anteriorly marked with a single dark brown dot; streak, from tip of snout just below eye and ending at dorsal base of pectoral fin is dark edged dorsally. Sometimes 3 fine white lines forward from eye and one behind eye at its upper edge, along with other reticulated fine white lines on side of head. Specimens 12 to 30 mm. in standard length have a broad whitish streak from dorsal half of eye posteriorly to dorsal edge of caudal peduncle; at rear bases of soft dorsal and soft anal occurs an ocellate black spot; at base of caudal fin and just above lateral line pores a dark spot about size of pupil, this may occur in specimens as large as 50 mm., but is minute and usually indistinct or absent on those about 12 mm. long.

On the adult male (Bleeker's "*renardi*") the paired white streaks are as follows: (1) The dorsalmost white streak begins at the nape on each side of middorsal line and continues along each side of base of dorsal fin, ending at dorsal edge of caudal peduncle just at or behind last ray; a streak (2) in front of eye on middle of snout at upper level of pupil, begins again at rear of eye at level of upper edge of pupil and extends across opercle just below upper edge of gill opening, with a very short branch extending ventrally from a point close to rear edge of opercle, behind the ventral branch a dark spot (below this streak and behind eye, extending to white streak (3), is a blackish area), streak (2) then continuing behind head on a slightly slanting course to midbase of caudal fin and ending on caudal fin at rear of scaled area; a streak (3) begins at middle front edge of preorbital, passes along ventral edge of eye and across opercle to dorsal edge of pectoral fin base, thence a very short distance to axil of pectoral, usually ending about opposite rear edge of pectoral fin base; a streak (4) begins on middle of cleithrum, then curves just under pectoral fin base and continues posteriorly, ending about opposite anus or opposite about the 11th to 13th lateral line scale. Background coloration brownish dorsally, paler ventrally, underside of head milky white; a small brownish dot or spot may occur at base of caudal fin just above lateral line; and there are traces of dusky spots at bases of last rays of dorsal fin and of anal fin.

Ecology.—This species was very rare in the intertidal zone of the northern Marshall Islands, but was taken twice in water 18 to 20 feet deep at Rongelap Atoll, whereas at Guam it occurred in the intertidal zone of the reef.

Remarks.—Randall (Copeia, No. 3, p. 237, 1955), on the basis of his study of specimens in the U. S. National Museum, finds that Bleeker's "*renardi*" represents the adult male of *strigiventer*. I agree with his observations and interpretations. This is another example of sexual dichromatism in reef fishes observable only when large series of well preserved specimens are available.

STETHOJULIS AXILLARIS (Quoy and Gaimard)

PLATE 100,E

Julis axillaris QUOY and GAIMARD, Voyage autour du monde . . . sur . . . l'*Uranie* et la *Physicienne*, Zoologie, p. 272, 1824 (type locality, Hawaiian Islands).

Stethojulis fulvoventris SEALE, Occ. Pap. Bishop Mus., Honolulu, vol. 1, No. 3, p. 92, 1901 (type locality, Guam).

Julis (*Halichoeres*) *bandanensis* BLEEKER, Nat. Tijdschr. Nederl.-Indië, vol. 2, p. 254, 1851 (type locality, East Indies).

SPECIMENS STUDIED

Bikini Atoll: 27 stations, 181 specimens, 21 to 92 mm. in standard length.
Eniwetok Atoll: 4 stations, 34 specimens, 13 to 80 mm.
Rongelap Atoll: 10 stations, 51 specimens, 33 to 87 mm.
Rongerik Atoll: 6 stations, 24 specimens, 20 to 91 mm.
Kwajalein Atoll: 1 station, 2 specimens, 38 to 63 mm.
Likiep Atoll: 1 lot, Univ. Washington, 2 specimens, 52 to 60 mm.
Wotje Atoll: 1 lot, 2 specimens, 65 to 70 mm.
Arno Atoll: 1 lot, 3 specimens, 66 to 67 mm.
Guam: 11 lots, 55 specimens, 13 to 70 mm.
Rota: 1 lot, 5 specimens, 29 to 71 mm.
Saipan: 1 lot, 1 specimen, 35 mm.

Description.—Dorsal rays IX,11, rarely IX,12; anal III,11; pectoral ii,12, rarely ii,11 or ii,12; pelvics always I,5; branched caudal fin rays usually 6+6; pores in lateral line 18 or 19+2 or 3+5 to 6, with 2½ above lateral line to rear of spiny dorsal base and 8½ below to anal origin; vertical scale rows from upper edge of gill opening to base of caudal fin 26; gill rakers 9 or 10+1+18 or 19.

Head 2.8 to 3.0; greatest depth 2.9 to 3.1; longest pectoral ray 4.8 to 5.2; snout tip to anus 1.6 to 1.7; snout to dorsal origin 2.7 to 2.8; all in standard length. Snout 2.7 to 3.1; eye 4.4 to 5.8; postorbital length of head 2.1; interorbital space 4.1 to 4.5; longest pectoral fin ray 1.6 to 1.7; least depth of body 2.4 to 2.6; all in length of head. Distance between anterior and posterior nasal openings 6 or 7 times in snout. Eye 1.0 to 1.6 in interorbital space.

Body moderately compressed; dorsal profile of head rounded, forming an angle of about 50 to 55 degrees with ventral contour of head;

a strong canine at corner of mouth; teeth uniserial, compressed, incisorlike, short, about 5 to 7 on each side in upper jaw and 7 to 10 on each side in lower jaw, all dentition is on anterior part of jaws, the anteriormost teeth not enlarged; lateral line continuous, dropping to midaxis of caudal peduncle at about 19 to 21 pores; pectoral fin reaches to opposite of about 9th or 10th lateral line pore; first or second branched ray from dorsal edge of pectoral fin longest; pelvics reach about two-thirds of way to anus; caudal fin rounded posteriorly.

Color in alcohol.—At lengths from 45 to 92 mm. dorsal half of body brown or grayish brown, lower sides abruptly paler, often separated by a pearly white streak running along midaxis of side from snout tip and just under orbit through white spot at dorsal edge of pectoral base to just below peduncular black spots, the latter encircled with a white ring; usually 2 black spots on the caudal peduncle but number may vary from 4 to none (on small specimens 30 mm. or shorter). Scale pockets on lower half of body are pearly or white edged; dorsal part of head and body minutely peppered with tiny white specks, these may be brownish, depending on preservation; middorsal line of snout near its tip with a black spot that may be lacking on larger specimens; both sides of pectoral fin base dark brown and sharply contrasting with pale or white pectoral fin; a pale or white streak on side of snout extends just under eye and usually to white pectoral spot.

At lengths from 30 to 47 mm. midside caudal peduncle with 2 small black specks one on each scale over pores; on base of caudal fin just above middle a small black spot, between last two or last 3 soft dorsal rays a black spot, between last two or last soft anal rays a fainter dark spot, and at middorsal line at front of snout a dark spot; dorsal surface of head peppered with tiny dusky specks, or with pale ones, depending on preservation. Peritoneum white or pale.

At lengths from 13 to 30 mm. the black spots on sides of caudal peduncle are usually lacking, whereas those dark spots on rear of soft dorsal, and soft anal fins are regularly present, and the one just above midaxis at base of caudal fin is present; black spot on snout present. Occasionally on young 25 to 30 mm. in standard length a black spot occurs basally on ventral edge of caudal fin.

Color when alive.—Black spots on caudal peduncle bordered with light blue; back grayish brown, everywhere finely spotted with close-set tiny blue dots; along midaxis of body a pinkish streak; lower sides whitish, tinged with pink; just above pectoral base is an orange blotch, below which is a bright blue spot on pectoral base; iris of eye orange; from below eye to tip of snout and including upper and lower lips is a yellow streak bordered ventrally and posteriorly with pink; posterior to the pink area and about under eye, a small bluish area.

STETHOJULIS LINEARIS, new species

PLATE 107,E

Stethojulis albovittata (non Bonnaterre) BLEEKER, Atlas ichthyologique . . . , vol. 1, p. 132, pl. 44, fig. 5, 1862 (East Indies).

Stethojulis casturi GÜNTHER, Journ. Mus. Godeffroy, vol. 3 (Fische der Südsee, vol. 2, pt. 7), p. 255, 1881; *ibid.*, vol. 3, pt. 8, pl. 141, fig. A, 1909 (on figure of Garrett). (Preoccupied by *Julis* (*Halichoeres*) *casturi* Bleeker (Nat. Tijdschr. Nederl.-Indië, vol. 3, p. 768, 1852) = *Stethojulis trilineata* (Bloch and Schneider).—SCHULTZ, U. S. Nat. Mus. Bull. 180, p. 214, 1943 (Phoenix and Samoan Islands).

Holotype.—USNM 112425, Bikini Atoll, Enyu Island, ocean reef at channel entrance, Aug. 1, 1947, S–46–483 Schultz, Brock and Hiatt, standard length 90 mm.

Paratypes.—USNM 112423, Bikini atoll, Enyu Island, Mar. 16, S–46–8, Schultz, Brock, and Marr, 1 specimen, 85 mm.; USNM 112422, Bikini Atoll, Erik Island, Mar. 19, S–46–9, Schultz and Brock, 1 specimen, 94 mm.; USNM 112432, Bikini Atoll, Airy Island, Apr. 17, S–46–97, Schultz, 2 specimens, 88 to 93 mm.; USNM 112421, Bikini Atoll, Cherry Island, Apr. 18, 1946, S–46–98, 1 specimen, 97 mm.; USNM 112414, Bikini Atoll, Bikini Island, July 16, S–46–253, Herald, 10 specimens, 92 and 102 mm.; USNM 112428, Bikini Atoll, Enyu Island, Aug. 13, S–46–333, Herald, 2 specimens, 76 to 92 mm.; USNM 112429, Bikini Atoll, Bikini Island, Aug. 14, S–46–349, Herald, 2 specimens, 84 to 92 mm.; USNM 112431, Bikini Atoll, Eman Island, July 17, 1947, S–46–405, Schultz, Brock and Myers, 2 specimens, 90 to 100 mm.; USNM 112430, Bikini Atoll, Eman Island, July 19, 1947, S–46–441, Schultz, Brock, Hiatt, and Myers, 2 specimens, 85 to 90 mm.; USNM 112426, Bikini Atoll, Bikini Amen reef, July 21, 1947, S–46–442, Brock, Hiatt, and Schultz, 3 specimens, 103 to 108 mm.; USNM 112427, Bikini Atoll, Namu Island, Aug. 6, 1947, S–46–508, Schultz, Brock, and Hiatt, 3 specimens, 86 to 90 mm.; USNM 112424, Bikini Atoll, Bikini Island, Aug. 18, 1947, S–42–533, Brock and Schultz, 1 specimen, 100 mm.; USNM 112419, Eniwetok Atoll, Rigili Island, May 30, S–46–189, Schultz, 1 specimen, 78 mm.; USNM 112420, Eniwetok Atoll, Teiteiripucchi Island, June 1, S–46–197, Schultz, 1 specimen, 87 mm.; USNM 112417, Rongelap Atoll, Eniaetak Island, June 17, S–46–215, Schultz, 1 specimen, 97 mm.; USNM 112418, Rongelap Atoll, Eniaetak Island, July 20, S–46–267, Herald and Brock, 1 specimen, 92 mm.; USNM 112415, Rongelap Atoll, Yugui Island, July 31, S–46–304, Herald, 8 specimens, 82 to 86 mm.; USNM 112416, Rongerik Atoll, Bock Island, June 27, S–46–237, Schultz and Herald, 4 specimens, 84 to 94 mm.; USNM 66038, Wotji Atoll, Marshall Islands, *Albatross* 1900, 1 specimen, 83 mm.; USNM 159902, Guam, 1945, mouth Ylig River in tidal pools, Dec. 23, 1945, Frey and Gressitt, 4 specimens, 54 to 77 mm.;

USNM 159901, Guam, 1945, Nov. 26, 1945, Frey, 5 specimens, 61 to 81 mm.; USNM 115621, Enderbury Island, 1939, Schultz, 2 specimens, 89 and 92 mm.; USNM 115622, Tutuila Island, Samoa, 1939, Schultz, 4 specimens, 82 to 90 mm.; USNM 115620, Canton Island, 1939, Schultz, 2 specimens, 61 to 76 mm.; USNM 52416, Apia, Samoa, Jordan and Kellogg, 3 specimens, 69 to 72 mm.; USNM 126619, Apia, Samoa, Jordan and Kellogg, 2 specimens, 68 to 73 mm.; USNM 71731, Nafa, Okinawa, *Albatross*, 1906, 2 specimens, 88 to 96 mm.; USNM 152227, Philippine Islands, Cebu Market, *Albatross*, 12 specimens, 73 to 82 mm.; USNM 152228 and 152229, Philippines, Sulade, Teomabel Island, *Albatross*, 2 specimens, 86 and 87 mm.

Description.—The following counts were made on the holotype: Dorsal rays IX,11; anal III,11; pectoral ii,12–ii,12; pelvics I,5; branched caudal rays 6+6; pores in lateral line 19+2+5; 2½ scales from lateral line to base of spiny dorsal and 8½ to anal origin; vertical scale rows from upper edge of gill opening 26; gill rakers 9 or 10+1+17 or 18; teeth each side of jaws, 8 in upper and 8 or 9 in lower. See table 103 for counts.

Detailed measurements were made on the holotype and one paratype; these data are expressed in thousandths of the standard length in the tabulation below:

	Holotype	*Paratype*
Standard length in mm	90	77
Length of head	333	331
Greatest depth	333	312
Least depth of caudal peduncle	127	122
Snout	136	114
Eye	53	62
Interorbital space	74	84
Postorbital length of head	156	162
Snout tip to anus	599	598
Snout tip to dorsal origin	392	360
Longest ray of:		
Pectoral	197	221
Pelvics	133	130
Dorsal spine	98	101
Anal spine	61	71
Caudal	200	234
Soft dorsal	111	119
Soft anal	100	109

Head 2.8 to 2.9; greatest depth 3.0 to 3.3; longest pectoral ray 4.8 to 5.0; snout tip to anus 1.7 to 1.8; snout tip to dorsal origin 2.5 to 2.6; all in standard length. Snout 2.7 to 2.9; eye 4.5 to 5.5; postorbital length of head 2.0 to 2.1; interorbital space 4.0 to 4.2; longest pectoral fin ray 1.6 to 1.7; least depth of body 2.6 to 3.0; all in length of head. Distance between anterior and posterior nasal openings 6 to 7 times in snout. Eye 1.1 to 1.5 in interorbital space.

Body a little compressed; dorsal profile rounded, forming an angle of about 60 degrees with ventral contour of head; teeth uniserial, compressed, incisorlike, short, about 7 or 8 on each side of upper jaw and 8 or 9 on lower; no enlarged or caninelike teeth anteriorly in jaws; pectoral fin reaches to opposite about 11th pore of lateral line; second branched ray from dorsal edge of pectoral fin longest; caudal fin rounded posteriorly.

Color in alcohol.—Background coloration on back and upper sides grayish brown or blackish, sharply contrasting with light grayish white ventrally and separated from it by a white streak along middle of sides. The paired white streaks, usually edged with a dark line, are located as follows: A white streak (1) beginning at dorsal edge of eye and extending toward nape, thence posteriorly on each side of middorsal line, along base of dorsal fin, this streak may be indistinct depending on preservation; another (2) beginning in middle of snout near middorsal line and extending to front of eye, beginning again on posterior side of eye, whence it slants dorsally then continues in a straight course posteriorly, passing over upper edge of gill opening, and continuing just below pores of lateral line, to end on the fourth or fifth scale behind upper edge of gill opening; another (3) beginning near middle of front edge of preorbital, passing just under lower edge of eye, across opercle, along dorsal edge of white area just above pectoral base, and thence slanting a little ventrally behind pectoral, to end on a vertical line passing through the 10th or 11th lateral line scale; another (4) beginning on under side of head a little behind the chin, curving dorsally just behind rear corner of mouth, thence across cheek and curving ventrally across lower tip of opercle, continuing dorsally along scaled edge of cleithrum, ending at front edge of pectoral base, and commencing again in axil of pectoral, then curving downward a little one scale row below white streak (3) and continuing a straight course to base of caudal fin just below lateral line pores.

Color when alive.—The streaks are bright blue, the first continues to dorsal edge of caudal fin, the third continues on middle three rays of caudal fin nearly to the tips of rays; area anterodorsally to pectoral fin base bright red; eye orange; lips and front part of head orange; dorsal fin pale orange; dorsal part of body grayish brown; lower sides and belly pearly, tinged with light bluish.

Ecology.—This species never occurred in abundance anywhere on the reefs; it seemed to prefer the reefs where there were luxuriant growths of algae and corals, and was frequently taken in the areas where the waves were strongest.

Remarks.—This new species has been confused with *S. albovittata* by nearly all authors since Günther first recognized it and gave it the name of *S. casturi*, which was based on a drawing and unfortunately is preoccupied.

Our large series of *S. linearis*, new species, has a constant color pattern that does not overlap with that of *S. albovittata* from the Hawaiian Islands and Johnston Island. White streaks (3) and (4) are separated by two scale rows in *albovittata* and by only one in *linearis*, and white streak (3) in *linearis* ends just behind the pectoral fin base, but in *albovittata* it continues to the caudal fin. We cannot agree with Weber and De Beaufort that *albovittata* and *linearis* are varieties of the same species, since color differences between them remain constant. Nor can we find a single specimen among our numerous paratypes from the Marshall, Phoenix, Samoan, and Philippine Islands in which there is the slightest indication of overlap in color pattern of white streaks numbers (3) and (4). After careful study of the reef fishes in numerous fish families of the tropical Indo-Pacific fauna, we are convinced that the basic color pattern is of the utmost importance in recognizing species and subspecies of fishes.

Named *linearis* in reference to the white lines or streaks that characterize this species.

Genus HEMIGYMNUS Günther

Hemigymnus GÜNTHER, Ann. Mag. Nat. Hist., vol. 8, p. 386, 1861 (type species, *Mullus fasciatus* Thunberg=*Labrus fasciatus* Bloch).

The following characters are useful in recognizing this genus: Branched caudal rays 6+6; lateral line pores 19+2+6 to base of caudal fin, usually 5 or 6 rows of scales above lateral line to soft dorsal origin and 11 or 12 below it to anal origin; dorsal rays IX,11; anal III,11, rarely III,12; pectoral ii,12; gill rakers about 6 to 8+1+15 to 21; body compressed; snout normal; dorsal profile of head convex; interorbital space convex; jaws terminal, equal or nearly so; lips thick, broad, somewhat plicate; lower lip deeply incised at middle; teeth uniserial, except in upper jaw a few teeth in an inner row anteriorly; a pair of canines at front of each jaw, those of upper jaw widely spaced so that those of lower jaw fit between them when mouth is closed; a broad flattish canine at corner of mouth embedded in fleshy tissues; preopercular margin free posteriorly and nearly an equal distance ventrally; gill membranes attached to isthmus, without a free fold across it.

The species of *Hemigymnus* of the Marshall and Marianas Islands are separated by the following key:

1*a*. Usually 4 to 6 narrow white bars on sides, alternating with broad black bars; gill rakers on first gill arch about 6+1+15 or 16__**H. fasciatus** (Bloch)

1*b*. Head to a little behind pectoral fin base white or pale, thence body blackish, except caudal peduncle which is pale; adults with generally brownish bodies; gill rakers on first gill arch about 8+1+20. **H. melapterus** (Bloch)

HEMIGYMNUS FASCIATUS (Bloch)

Plate 101,D

Labrus fasciatus Bloch, Naturgeschichte der ausländischen Fische, vol. 6, p. 6, pl. 290, 1792 (type locality, Japan).

SPECIMENS STUDIED

Bikini Atoll. 4 stations, 5 specimens, 75 to 151 mm. in standard length. 1 lot, Univ. Washington, 2 specimens, 52 to 146 mm.

Description.—Head 2.5 to 2.7; greatest depth 2.4 to 2.5; longest pectoral ray 4.4 to 4.7; snout tip to anus 1.7; snout to dorsal origin 2.3 to 2.4; all in standard length. Snout 2.1 to 2.4; eye 4.5 to 6.5; postorbital length of head 2.1 to 2.2; interorbital space 3.9 to 4.1; longest pectoral ray 1.6 to 1.7; least depth of body 2.0 to 2.1; all in length of head. Eye in fleshy interorbital space 1.4 to 1.9.

Dorsal profile of head forming an angle of about 65 to 70 degrees with the ventral contour of head; pectoral fin reaches to opposite about ninth or tenth lateral line pore; second soft pelvic ray longest, reaching to or nearly to anus; distal margin of caudal fin a little rounded.

Color in alcohol.—Background coloration of body blackish, with 4 white bars, the first from between bases of dorsal spines IV and V, continuing behind pectoral base and meeting its fellow halfway between pectoral base and anus; second from base of first soft dorsal ray to anus; third from between bases of soft dorsal rays 5 and 6 to middle of length of anal fin base; and fourth, usually very faint, just behind rear end of bases of dorsal and anal fins across caudal peduncle; head and breast in front of pelvic and pectoral bases whitish; a dusky spot behind eye; base of pectoral fin black, the fin hyaline; pelvic and anal fins black; dorsal and caudal fins dark brown; usually a few black spots posteriorly on body, one near midbase of caudal fin and one (about 3 scale rows in front of it) on caudal peduncle are constant; side of head with lengthwise streaks below eye. The young specimen, 52 mm. long, has 6 narrow vertical white bars, and several white streaks radiating from eye, some meeting on ventral line under head; body and head blackish.

Ecology.—This species was seldom seen or taken on the reefs or in deeper water.

Remarks.—Specimens in the U. S. National Museum indicate that one or more races or subspecies may be included under the name *fasciatus*, but sufficient material on which to base definite conclusions is not available at this time. Differences are noted in regard to color pattern; specimens from the Marshall, Philippine, and Samoan Islands have much narrower white bars than those from Japan and Okinawa, a condition that needs further study.

HEMIGYMNUS MELAPTERUS (Bloch)

Plate 101,C

Labrus melapterus Bloch, Naturgeschichte der ausländischen Fische, vol. 5, p. 137, pl. 285, 1791 (type locality, Japan).

SPECIMENS STUDIED

Bikini Atoll: Bikini Island, August 14, 1946, S–46–349, 1 specimen, 84 mm.

Likiep Atoll: Likiep Island, August 22, 1949, Univ. Washington, 1 specimen, 91 mm.

Description.—Head 2.6 and 2.7; greatest depth 2.4 and 2.5; longest pectoral ray 4.3 to 4.7; snout tip to anus 1.6 to 1.7; snout to dorsal origin 2.2 to 2.3; all in standard length. Snout 2.2 to 2.3; eye 4.8 to 5.0; postorbital length of head 2.1 to 2.3; interorbital space 3.8 to 4.2; longest pectoral ray 1.6 to 1.8; least depth of body 2.0 to 2.1, all in length of head. Eye in fleshy interorbital space 1.2 to 1.3.

Dorsal profile of head forming an angle of 60 to 65 degrees with ventral contour of head; pectoral fin reaches to opposite ninth or tenth lateral line pore; first or second outer soft pelvic ray longest, reaching anus or nearly so; distal margin of caudal fin rounded on young; lips white.

Color in alcohol.—Dorsal part of head light brownish, lower sides paler, ventrally whitish; a broad white bar from dorsal origin through pectoral base (and behind it ventrally for about half length of pectoral fin), to pelvics, which are whitish; abruptly behind this bar the body is blackish or dark brownish, including dorsal and anal fins; caudal peduncle pale or light tan; caudal fin a little dusky posteriorly; pectoral hyaline; a small black spot at midbase of caudal fin and sometimes one or two more on middle of side. Larger specimens are generally more brownish and the white bar is indistinct and mostly confined to ventral part of body.

Genus ANAMPSES Quoy and Gaimard

Anampses Quoy and Gaimard, Voyage autour du monde . . . sur . . . l'*Uranie* et la *Physicienne*, Zoologie, p. 276, 1824 (type species, *Anampses cuvieri* Quoy and Gaimard).

The following characters are useful in recognizing this genus: Dorsal rays IX,12; anal III,12; pectoral rays ii,11 or 12; branched caudal rays 6+6; lateral line pores to base of caudal fin 19 (rarely 18 or 20)+2+4 to 6; scales above lateral line to base of first soft dorsal ray 3 or 4, and 10 or 11 to anal origin; gill rakers about 6 to 8+1+8 to 11; body compressed, snout normal; dorsal profile of head a little convex; jaws terminal; a single pair of enlarged teeth at symphysis of each jaw, these teeth flattish, chisel-like, with more or less a "cutting edge"; pair in upper jaw curves outward and upward and those of lower jaw outward and downward; sometimes a uniserial row of minute teeth on each jaw usually visible by dissection; lower pair fitting between upper pair when mouth is closed; preopercular edge free posteriorly and an equal distance ventrally; gill membranes attached to sides of isthmus, no free fold.

The chief differences between *Anampses* and *Pseudanampses* are the more numerous scales in the latter, about 33 or 34+4 to 6+10 or 11 totaling 45 to 50 and 19+2+4 to 6 totaling 25 to 30 in *Anampses*.

Randall (Journ. Washington Acad. Sci., vol. 48, pp. 100–108, 1958) described from the Hawaiian Islands *A. rubrocaudata* (pl. 102, A), a species which is close to *A. meleagrides* Cuvier and Valenciennes, and which may occur in this area.

The following key distinguishes the 2 species collected:

1*a*. Rear of soft dorsal and of soft anal fins with an ocellate black spot; head without blue spots or blue streaks ---------------------- **A. twisti** Bleeker

1*b*. No ocellate spot on any of the fins; head with blue spots or blue streaks. **A. caeruleopunctatus** Rüppell

Table 104.—*Counts for certain species of* Pseudanampses *and* Anampses

Genus and species	Fin rays						
	Dorsal		Anal		Pectoral		
	IX	12	III	12	ii	11	12
Pseudanampses:							
geographicus	3	3	3	3	6	6	---
pterophthalmus	7	7	7	7	14	14	---
Anampses:							
caeruleopunctatus	11	11	11	11	22	22	---
twisti	4	4	4	4	8	6	2
cuvieri	7	7	7	7	14	4	---
godeffroyi	2	2	2	2	4	4	---
meleagrides	7	7	7	7	14	14	---

Genus and species	Pores in lateral line to base of caudal fin																												
	Anterior part																Oblique part					Peduncular part							
	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	2	3	4	5	6	4	5	6	7	8	9	10	11
Pseudanampses:																													
geographicus	---	---	---	---	---	---	---	---	---	---	---	---	---	---	2	1	---	---	---	2	1	---	---	---	---	---	---	1	2
pterophthalmus	---	---	---	---	---	---	---	---	---	---	---	---	---	---	2	5	---	---	1	6	---	---	---	---	---	---	---	7	---
Anampses:																													
caeruleopunctatus	11	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	11	---	---	---	---	---	---	11	---	---	---	---	---
twisti	3	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	4	---	---	---	---	1	3	---	---	---	---	---	---
cuvieri	7	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	7	---	---	---	---	---	---	7	---	---	---	---	---
godeffroyi	2	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	2	---	---	---	---	---	---	2	---	---	---	---	---
meleagrides	8	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	8	---	---	---	---	---	6	2	---	---	---	---	---

ANAMPSES TWISTI Bleeker

Plate 102,C

Anampses twisti Bleeker, Act. Soc. Sci. Indo-Néerl., vol. 1, p. 56, 1856 (type locality, Ambonia); Atlas ichthyologique . . . ,vol. 1, p. 105, pl. 25, fig. 4, 1862.

Anampses fidjensis Sauvage, Bull. Soc. Philomath Paris, ser. 7, vol. 4, p. 224, 1880 (type locality, Fiji).

SPECIMENS STUDIED

Rongerik Atoll: Latoback Island, lagoon reef, August 14, 1947, Brock, Schultz and Donaldson, 2 specimens, 90 and 92 mm.

In addition, two other specimens were studied, one from the Philippines and the other from Mauritius.

Description.—Certain counts are recorded in table 104. Scales above lateral line 3 or 4 and 10 below to anal fin origin.

Head 2.8 to 2.9; greatest depth 2.8 to 3.2; longest pectoral ray 4.8 to 5.1; snout tip to anus 1.8 to 1.9; snout to dorsal origin 2.8 to 3.0; all in standard length. Snout 2.8 to 3.1; eye 4.0 to 5.0; postorbital length of head 2.0; interorbital space 3.7 to 4.0; longest pectoral ray 1.7; least depth of body 2.0 to 2.2; all in length of head. Eye in fleshy interorbital space 1.2 to 1.5.

Dorsal profile of head forming an angle of about 55 to 65 degrees with the ventral contour of head; pectoral fin reaches to opposite about the tenth pore of lateral line; outer rays of pelvics elongate, reaching to anal origin; distal margin of caudal fin rounded.

Color in alcohol.—Background coloration dark brown, except belly and ventral part of head, which are light brown or tan; dorsal and anal fins brown, edged with a white line, and with a large black ocellate spot on the ninth to eleventh soft rays of both fins, these spots on basal ¾ of fins; median fins with pale spots or caudal fin brownish or light brown, broadly bordered with white; paired fins white or pale; pectoral fin base blackish; opercular flap with a black spot; each scale with a small pale or white spot. A pale band along back from snout to dorsal edge of caudal peduncle.

Color when alive.—Both Rongerik Atoll specimens were photographed in color and the following description is based on the kodachromes: Dorsally, head and body purplish brown, belly and lower part of head yellowish; each scale with a small blue spot; a light olive band along middorsal line of snout, posteriorly along base of dorsal fin, and ending on dorsal edge of caudal peduncle; black spot in dorsal and anal fins bordered with blue; caudal fin posteriorly yellowish with lighter spots. Base of pectoral fin brown; eye pinkish.

Remarks.—The two specimens from Rongerik Atoll do not exactly agree in coloration with the specimen from the Philippines nor the one from Mauritius, both of which lack the pale band along the back. In addition, the specimen from Mauritius has ii,12 pectoral rays whereas the others have ii,11. Bleeker's figure of *A. twisti* does not show the pale band along the back, nor does Sauvage mention it in his description of *A. fidjensis.* It is possible that our two specimens from the Marshall Islands represent a closely related species, but there are not enough specimens to decide this now. The red opercular spot shown in Bleeker's figure does not appear in the two kodachrome transparancies.

ANAMPSES CAERULEOPUNCTATUS Rüppell

PLATE 102,B

Anampses caeruleo-punctatus RÜPPELL, Atlas zu der Reise im nördlichen Afrika . . . Fische des Rothen Meers, p. 42, pl. 10, fig. 1, 1828 (type locality, Red Sea).—BLEEKER, Atlas ichthyologique . . . , vol. 1, pl. 24, fig. 2, 1862.

SPECIMENS STUDIED

Bikini Atoll: 7 stations, 8 specimens, 63 to 197 mm. in standard length. 1 lot, Univ. Washington, 1 specimen, 42 mm.

Rongerik Atoll: 2 stations, 6 specimens, 94 to 113 mm.

Description.—Certain counts made on several species of *Anampses* are recorded in table 104. Scales above lateral line to base of first soft dorsal ray are 3 or 4 and below to anal origin are 10 or 11.

Head 2.7 to 3.0; greatest depth 2.7 to 2.9; longest pectoral ray 4.5 to 4.8; snout tip to anus 1.8 to 1.9; snout to dorsal origin 2.7 to 3.2; all in standard length. Snout 2.5 to 3.2; eye 5 to 7.5; postorbital length of head 1.9 to 2.0; interorbital space 4.0 to 4.7; longest pectoral ray 1.6 to 1.8; least depth of body 2.2 to 2.3; all in length of head. Eye in fleshy interorbital space 1.2 to 3.0.

Dorsal profile of head forming an angle of about 65 to 75 degrees with the ventral contour of head; pectoral fin reaches to opposite about the tenth or eleventh lateral line pore; outer rays of pelvics elongate, reaching about to anal fin origin, distal margin of caudal rounded in young, truncate in adults.

Color in alcohol.—In adults, the background coloration light tan to dark brown, each scale with a brown bordered blue spot (this blue spot usually pale or white in alcohol but may preserve as brownish); head and caudal fin lighter in shade than body, or lighter basally with distal half dusky, then distal margin white edged, especially notable between lengths of 105 to 197 mm.; caudal fin blue spotted, head with blue streaks or blue spots more or less in rows. The blue streaks on head are arranged as follows: three radiate from dorsal part of eye, the two anterior ones crossing interorbital space; three extend ventrally from lower part of eye, the anterior one bent sharply forward and extending to snout, the posterior one bent and curved posteriorly and extending to fleshy tip of opercular flap, two streaks occur on mouth, and dots and streaks occur on opercle, subopercle, and interopercle; isthmus blue streaked. Other blue streaks and dots occur on pectoral base and below it. There is some variability in the arrangement of these blue streaks. Outer edges of pelvics, dorsal, and anal fins pale blue when alive; dorsal and anal fins with pale spots (blue when alive).

Young between lengths of 42 to 113 mm. differ from those about 100 mm. and longer in having the head blue spotted, these brown-bordered spots occur in the places where, at larger sizes, they become elongated and at about 93 mm. form the blue streaks. At a length of 63 mm. the only blue streak completely formed occurs on anterodorsal edge of eye; the caudal fin usually has a pale area basally then distally it may be dark brown, with a broad white edge posteriorly.

Two specimens, one from Bock Island, Rongerik Atoll, and one from Bikini, both collected by the University of Washington, have a broad pale bar across the caudal fin basally sharply contrasting with dark brown posteriorly, the distal fourth to third of caudal fin is white.

Color when alive.—Background coloration purplish brown, all spots and streaks are bright blue.

Ecology.—This species is uncommon in the intertidal zone of the reef but was observed more frequently in the lagoon in deeper water.

Genus HALICHOERES Rüppell

Halichoeres Rüppell, Neue Wirbelthiere zu der Fauna von Abysinnien gehörig, Fische, p. 14, 1835 (type species, *Halichoeres bimaculatus* Rüppell).

This genus as currently recognized contains a large number of species, some of which are ill-defined. Among those studied by me, small differences in the number of fin rays occur among some of the species as recorded in table 105. Careful attention to color pattern indicates that it is of much importance in the recognition of species, however, one must be cautious in regard to coloration since there may be considerable difference between mature males and mature females. The small young of each species of *Halichoeres* may have a color pattern strikingly different from that of the adults of the same species such as in *H. hortulanus.* It was observed in a few species that the black ocellate spot between soft dorsal rays 1 to 5 may disappear on the adults. The presence of a black spot or 2 black spots on caudal peduncle is highly irregular in certain species.

The following characters are useful in recognizing this genus: Dorsal rays IX (rarely X),11 to 13; anal III,10 to 13; pectoral ii,10 to 13; branched caudal fin rays 6+6; pores in lateral line 19 or 20+2+5 or 6; usually 3 rows of scales above lateral line and 8 or 9 below it to anal origin; gill rakers usually about 6 or 7+1+10 to 12 on first arch; body strongly compressed. Snout normal; dorsal profile convex; interorbital space convex; nostrils minute, anterior pair tubular, short; jaws terminal, equal or nearly so; teeth short, conical, uniserial, anterior middle pair in both jaws enlarged pointing obliquely forward (sometimes on upper jaw 2 pairs are enlarged) lower pair fitting between upper pair when mouth is closed; preopercular margin free posteriorly and an equal distance ventrally; gill membranes attached to isthmus with a narrow free fold across it.

In order to identify the specimens forming the basis of this study it was necessary to examine numerous exotic species. During these investigations, it was noted that Schmidt (Trans. Pacific Comm. Acad. Sci. U. S. S. R., vol. 1, p. 83, pl. 6, fig. 1, 1930) illustrated *Halichoeres prosopeion* (not of Bleeker), which is an excellent representation of *Halichoeres melanochir* Fowler and Bean. Herre (Field Mus. Nat. Hist., Zool. Ser., vol. 18, No. 12, p. 410, 1935, and vol. 21, p. 313, fig. 14, 1936) described *Halichoeres fijiensis* from the Fiji Islands, which is a synonym of *Halichoeres leparensis* (Bleeker), as based on Herre's figure 14 and two paratypes (USNM 117326–7).

I am convinced after studying a series of *Halichoeres nigrescens* (Block and Schneider) as illustrated by Bleeker (Atlas ichthyologique . . . , vol. 1, pl. 37, fig. 4, 1862) that *Halichoeres leucostigma* Fowler and Bean, (U. S. Nat. Mus. Bull. 100, vol. 7, p. 299, pl. 40, 1928) is a synonym of *nigrescens*. The white spots mentioned by Fowler and Bean are faint to distinct and the color marks on the sides of the head are the same. The genus *Halinanodes* proposed by Whitley (Rec. Australian Mus., vol. 18, No. 3, p. 113, 1931), with *H. leucostigma* Fowler and Bean as its type species, lacks valid characters.

TABLE 105.—*Counts recorded for certain species of* Halichoeres

Species	Fin rays														
	Dorsal					Anal					Pectoral				
	IX	X	11	12	13	III	10	11	12	13	ii	10	11	12	13
trimaculatus	11	-----	11	-----	-----	10	-----	10	-----	-----	17	-----	-----	14	3
scapularis	9	-----	8	1	-----	9	-----	9	-----	-----	18	-----	-----	16	2
hortulanus	10	1	11	-----	-----	13	-----	13	-----	-----	22	-----	-----	21	1
centriquadrus	5	-----	5	-----	-----	5	-----	5	-----	-----	6	-----	-----	6	-----
margaritaceus	17	-----	17	-----	-----	17	-----	17	-----	-----	30	-----	28	2	-----
miniatus	8	-----	8	-----	-----	8	1	7	-----	-----	8	2	16	-----	-----
nebulosus	10	-----	10	-----	-----	10	1	9	-----	-----	19	-----	19	-----	-----
binotopsis	9	-----	9	-----	-----	9	-----	9	-----	-----	13	-----	-----	12	1
leparensis	13	-----	-----	13	-----	14	-----	1	13	-----	10	-----	-----	25	1
argus	8	-----	-----	8	-----	8	-----	2	6	-----	16	-----	4	12	-----
biocellatus	4	-----	-----	4	-----	4	-----	-----	4	-----	8	-----	8	-----	-----
hoeveni	13	-----	1	10	2	13	-----	1	11	1	22	-----	-----	21	1
kallochroma	6	-----	-----	6	-----	6	-----	-----	6	-----	10	-----	-----	10	-----
notopsis	15	-----	-----	-----	15	15	-----	1	12	2	18	-----	-----	18	-----
marginatus	8	-----	-----	-----	8	8	-----	-----	8	-----	13	-----	-----	13	-----

KEY TO THE SPECIES OF HALICHOERES FROM THE MARSHALL ISLANDS AND TO ALLIED SPECIES FROM OTHER AREAS

1*a*. Patch of scales on upper part of opercle; dorsal rays usually IX,11; anal III,11; pectoral ii,12 or 13 (occasionally ii,13).

2*a*. A small patch of scales above and behind eye and another behind and below eye, or if these scales have not developed in young, a large dark ocellate spot occupies almost all the first 4 or 5 soft dorsal rays.

3*a*. Adults: Background coloration pale; dorsally each scale with two small black dots (sometimes connected with blackish pigment) and lower sides each scale with one black dot; a whitish area on back opposite dorsal spines III to V, another on back opposite dorsal soft rays 4 to 6, and a third on dorsal edge of caudal peduncle; the areas between blackish.

4*a*. A dusky spot, size of pupil, near dorsal base of caudal fin rays; plate 104,E. (Red Sea; Mauritius; Madagascar.)
H. centriquadrus (Lacepède)

4*b*. No dark spot on caudal fin rays---------- **H. hortulanus** (Lacepède)

3*b*. Young: A large black ocellate spot on first 4 or 5 soft dorsal rays; background coloration pale, with three broad darkish or blackish bars composed of blotches, first on head, second at middle of length, and third on caudal peduncle. Two dark streaks on head, the lower one meeting its fellow on under side of lower jaw.
H. hortulanus (Lacepède)

2*b*. No patches of scales around eye as in 2*a*.

5*a*. A large blotch or silvery spot on dorsal side of caudal peduncle; each scale with a vertically elongate dusky bar, except those ventrally.
H. trimaculatus (Quoy and Gaimard)

5*b*. No dark blotch on caudal peduncle; centers of scales with elongate silvery bars; sometimes a series of dusky spots along upper sides.
H. scapularis (Bennett)

1*b*. No patch of scales on opercle and none around eye; head naked except at occiput.

6*a*. Dorsal and anal soft rays normally 11, rarely 10 (see table 105).

7*a*. Pectoral rays normally ii,11 rarely ii,10 or ii,12; background coloration pale or whitish, sides variably blotched with dark shades; a small black spot between dorsal spines I and II.

8*a*. Anal fin distinctly spotted with dark dots on posterior sides of each ray; soft dorsal fin with similar dark spots; the black ocellate spot between soft dorsal rays 1 to 3 occupies their basal two-thirds; abdomen under pectoral fin to pelvic fin with a white bar on each row of scales, the posterior edge of each bar opposite each scale with a posteroventrally projecting short triangular white point; plate 104,C------------ **H. miniatus** (Cuvier and Valenciennes)

8*b*. Anal fin without dark dots; abdomen without white spots as in 8*a*.

9*a*. Cheek below eye with elongate pale and dark lengthwise streaks; dorsal fin transversely barred, these often enclosing roundish white spots; the black ocellate spot on soft dorsal rays 1 to 3 is a little closer to distal edge of rays than their base.
H. margaritaceus (Cuvier and Valenciennes)

9*b*. Cheek below eye with a pale and dark concentric marking; dorsal fin transversely barred; the black ocellate spot on dorsal soft rays 1 to 4 occupies the basal two-thirds of the rays; plate 104,A.
H. nebulosus (Cuvier and Valenciennes)

7*b*. Pectoral rays normally ii,12; pectoral base with a dark bar; sides with 6 or 7 dusky bars; middorsal line of head with a white streak; pale and dark marks on lower sides of head arranged as lengthwise streaks.
H. binotopsis (Bleeker)

6*b*. Dorsal and anal soft rays usually 12 or 13, rarely 11.

10*a*. Dorsal soft rays 12, rarely 11 or 13.

11*a*. Soft dorsal fin with 2 dark ocellate spots, first on rays 1 to 3 and second on rays 9 to 11; branched pectoral rays 11; a prominent pale or whitish streak behind head just above level of pectoral base---------------------------**H. biocellatus**, new species

11*b*. Soft dorsal fin with a single dark ocellate spot or none, branched pectoral rays usually 12, occasionally 11 or 13.

12*a*. Coloration consisting of 9 to 12 alternating pale and brownish streaks, the brownish ones as wide as or wider than pale ones; greatest depth 3.1 to 3.4; a black spot may occur on caudal fin base about halfway between lateral line and dorsal edge.

13*a*. A black spot basally between dorsal spines I and II; a black spot in basal half of soft dorsal rays 1 to 4.
H. hoeveni (Bleeker)

13*b*. No black spot in dorsal fin---------**H. kallochroma** (Bleeker)

12*b*. Coloration not as in 12*a*; no dark bar on base of pectoral fin; center of each scale with dusky-bordered pale or whitish (probably blue when alive) spots;

14*a*. Pale spots or streaks on the scales below pectoral fin on abdomen (blue when alive); distally the middle rays of caudal fin blackish; an oblique dusky streak extending from below eye to under rear of lower jaw, then behind it 2 pale blotches, one below orbit, the other on lower part of operculum, separated by a vertically extending dusky streak; plate 104,B--------------------**H. argus** (Bloch and Schneider)

14*b*. Scales below pectoral fin in front of anus margined with white line; pale and dark marks on lower sides of head arranged as lengthwise streaks; usually several prominent pearly white specks on sides of body; plate 105,D
H. leparensis Bleeker

10*b*. Dorsal soft rays normally 13; pectoral rays ii,12.

15*a*. Background coloration brown to dark brown with few to many lengthwise alternating pale and dark streaks; dorsal and anal fins barred or mottled with darker shades; a small black ocellate spot basally between dorsal spines I and II, and a second one between soft dorsal rays 2 to 5; caudal fin varying from whitish in young to blackish in subadults, with the distal edge whitish. Young; known as *H. notopsis* (Cuvier and Valenciennes).
H. marginatus Rüppell

15*b*. Background coloration blackish to dark brown with center of each scale darker; dorsal and anal fins blackish with numerous light spots; margin of these fins white; scaled part of caudal fin black basally, central portion abruptly whitish or light brown, then with a broad new-moon-shaped black cross bar, distally whitish. Adults-----------------------------**H. marginatus** Rüppell

HALICHOERES HORTULANUS (Lacepède)

PLATE 103

Labrus hortulanus LACEPÈDE, Histoire naturelle des poissons, vol. 3, pp. 449, 518, pl. 29, lower figure, 1802 (type locality, "Great Equitorial Ocean"=Indo-Pacific).

Julis (*Halichoeres*) *notophthalmus* BLEEKER, Verh. Bataviaasch Gen., vol. 22, p. 20, 1849 (type locality, Batavia).

Hemitautoga notophthalmus BLEEKER, Atlas ichthyologique . . ., vol. 1, p. 140, pl. 21, fig. 1, 1862 (Java, Celebes, Goram, Timor, Nova-Guinea).

Halichoeres hortulanus SEALE, Occ. Pap. Bishop Mus., vol. 1, no. 3, p. 88, 1901 (Guam).

Halichoeres nigrescens (non Bloch and Schneider) FOWLER, Proc. Acad. Nat. Sci. Philadelphia, vol. 98, p. 166, fig. 33, 1946 (Riu Kiu Islands).

SPECIMENS STUDIED

Bikini Atoll: 16 stations, 57 specimens, 27 to 170 mm. 3 lots, Univ. Washington, 3 specimens, 26.5 to 50 mm.

Rongerik Atoll: 4 specimens, 7 specimens, 70 to 126 mm.

Eniwetok Atoll: 1 station, 1 specimen, 55 mm.

Rongelap Atoll: 4 stations, 5 specimens, 49 to 139 mm.

Guam: 1 lot, 1 specimen, 34 mm.

Description.—Certain counts are recorded in table 105. Pores in lateral line 19 or 20+2+5 or 6.

Head 2.5 to 3.0; greatest depth 2.9 to 3.0; longest pectoral ray 4.3 to 5.0; snout tip to anus 1.7 to 1.9; snout to dorsal origin 2.5 to 2.8; all in standard length. Snout 2.5 to 3.3; eye 3.4 to 6.5; postorbital length of head 2.0 to 2.1; interorbital space 3.8 to 4.5; longest pectoral ray 1.5 to 1.9; least depth of body 2.0 to 2.3; all in length of head. Distance between anterior and posterior nasal openings 5 to 8.5 in snout. Eye 0.8 to 1.6 in fleshy interorbital space.

Dorsal profile of head forming an angle of about 60 to 70 degrees with ventral contour of head; pectoral fin reaches to opposite about tenth or eleventh lateral line pores; pelvics with outer soft ray somewhat elongated; distal margin of caudal fin slightly rounded, nearly truncate.

Color in alcohol.—Adult background coloration whitish or pale, each scale of body with two small black dots, sometimes connected with blackish pigment; below level of middle of pectoral base scales with one blackish dot, none ventrally; a whitish area on back opposite the dorsal spines III to V, the area on back opposite V to IX dorsal spines blackish, then dusky to the second white spot opposite the fourth to sixth soft rays; third white spot on dorsal edge of caudal peduncle just behind rear of dorsal fin base; anal, caudal, pectoral, and pelvic fins plain pale; dorsal usually with round pale spots, bordered with dusky basally; dorsal edge of pectoral fin base with black spot; axil of pectoral fin base whitish, a dusky spot in whitish area.

A specimen 55 mm. long has the adult color pattern except that the ocellate dorsal spot is present.

Background coloration of young (55 mm. and shorter in standard length) whitish or pale, with three broad darkish or blackish bars composed of blotches, first across head to breast, second across middle of length, and third on caudal peduncle. Head with dark streak from snout tip through eye to tip of operculum, another from under side of lower jaw below eye to base of pectoral, this bar V-shaped, since it meets its fellow on under side of lower jaw; two dark spots on dorsal surface of head between nasal openings.

The following variation in color connects the juvenile color pattern with that of the adults, (all measurements of length refer to the standard length): At lengths of 26.5, 27, 34, 42, 45, 47, 49, 50, 55, 57, and 59 mm. the dark ocellate spot in the soft dorsal fin on the first 4 or 5 rays is distinct, whereas at lengths of 57, 67, 70, and 73 mm. this ocellate spot has almost blended into the adult color pattern (round whitish areas surrounded by dusky pigment) of the dorsal fin. The three blackish bars are distinct (middle one contains the dark ocellate spot) at lengths of 16, 26.5, 27, 34, 42, 45, and 50 mm. At lengths of 42, 45, and 50 mm., the dark bars are becoming less distinct and the dark spots on the scales are beginning to form. The black spots on the scales are well formed at lengths of 47, 49, 50, 55, 57, and 59 mm., and on all larger specimens; at these sizes the round whitish spots on dorsal fin are distinct. A black spot at base of first dorsal spine is distinct at lengths of 42, 45, and 55 mm. There are black spots or blotches at base of each pelvic fin, on ventral side of body in front of anus, at front of soft rays of anal fin, and at ventral side of caudal peduncle just behind rear of anal fin base at lengths of 26.5, 27, 34, and 42 mm. The second white area on back next to base of dorsal fin begins to appear at lengths of 50, 55, 58, 59, and 60 mm. The third white one at dorsal edge of caudal peduncle just behind rear of dorsal fin base appeared faintly at lengths of 55, 73, and 80 mm. The brown stripes on the head characteristic of the young, were changing into whitish streaks at lengths of from 60 to 75 mm.

Color when alive.—Background color of body whitish; dorsal, caudal, anal, and pelvic fins golden yellow; 3 light areas along back, yellow; light round spots on dorsal fin yellow; base of pectoral yellow; light spots on body in front of dorsal origin and above pectoral fin, pinkish to orange; light streaks on head pinkish bordered with purplish; lower part of head yellowish; dark spots on scales purplish-black; eye orange; dark pectoral spot purplish black or dark blue; dark spot in axil of pectoral base brownish red.

Ecology.—This species was common in the intertidal zone of the reef where ample growths of corals and algae occurred, and it occurred in lagoon to depths of at least 30 feet.

Remarks.—There occurred in the series of specimens of this species collected in the tropical Indo-Pacific Oceans sizes intermediate between the adults recognized as *H. centriquadrus* (Lacepède) by authors, and the juveniles recognized as *H. notophthalmus* (Bleeker). The specimens to which I refer are the "young" described under "Color in alcohol." They show a complete color pattern change from the dark barred pattern of *notophthalmus* to that of the adult *hortulanus*. The most remarkable change is that of the dark ocellate spot in the soft dorsal fin which breaks up to help form the light round spots surrounded with dusky pigment in the basal half of the dorsal fin.

In attempting to straighten out the nomenclature as the result of the discovery that *notophthalmus* is the young stage of *hortulanus*, specimens were examined from numerous localities in the Indo-Pacific. It was observed that our specimens from Mauritius differed from those of the tropical Pacific in having a small but distinct dark caudal spot, beautifully illustrated by Rüppell (Neue Wirbelthiere zu der Fauna von Abysinnian gehörig, Fische, p. 16, pl. 5, fig. 1, 1835) under the name *Halichoeres epimius*, for a Red Sea specimen. Since Lacepède was the first to describe *Labrus centriquadrus* (Histoire naturelle des poissons, vol. 3, pp. 437, 493, 1802; type localities, Madagascar, Mauritius, Reunion) I herewith restrict the species to the form with the dark spot in the dorsal part of the caudal fin base, on the basis of 3 specimens from Mauritius, USNM 19994 and 130984.

The two species, *centriquadrus* and *hortulanus* may be distinguished by the key on p. 224.

The smallest specimen I have seen of this species is 16 mm. long, from Morotai Island. It has the same coloration as those 26 to 27 mm.

HALICHOERES TRIMACULATUS (Quoy and Gaimard)

PLATES 102,E; 106,C

Julis trimaculata QUOY and GAIMARD, Voyage de . . . l'*Astrolabe* . . . , Zoologie, vol. 3, p. 705, pl. 20, fig. 2, 1834 (type locality, Vanikolo).

Güntheria trimaculata BLEEKER, Atlas ichthyologique . . . , vol. 1, p. 138, pl. 32, fig. 1, 1862 (Cocos, Celebes, Sangi, Flores, Buru, Amboina, Haruko, Banda, Goram, Letti).

SPECIMENS STUDIED

Bikini Atoll: 25 stations, 385 specimens, 10 to 130 mm. in standard length.
Rongerik Atoll: 5 stations, 31 specimens, 20 to 118 mm.
Eniwetok Atoll: 6 stations, 77 specimens, 16 to 98 mm.
Rongelap Atoll: 13 stations, 216 specimens, 26 to 219 mm.
Likiep Atoll: 1 lot, Univ. Washington, 6 specimens, 30 to 53 mm.
Guam: 6 lots, 67 specimens, 28 to 93 mm.
Rota: 2 lots, 13 specimens, 20 to 58 mm.

Description.—Certain counts are recorded in table 105.

Head 2.7 to 3.0; greatest depth 3.2 to 3.3; longest pectoral ray 4.3 to 5.0; snout tip to anus 1.7 to 1.8; to dorsal origin 2.8 to 3.1; all in standard length. Snout 2.7 to 3.6; eye 4.1 to 6.0; postorbital length of head 1.9 to 2.0; interorbital space 4.7 to 5.6; longest pectoral ray 1.6 to 1.7; least depth of body 2.0 to 2.1; all in length of head. Distance between anterior and posterior nasal openings 5 to 8 in snout. Eye 0.8 to 1.4 in interorbital space.

Dorsal profile of head forming an angle of 65 to 70 degrees with ventral contour of head; pectoral fin reaches to opposite ninth or tenth lateral line pores; pelvics with outer rays elongate, reaching nearly to anus; distal margin of caudal fin rounded.

Color in alcohol.—Background coloration light grayish to yellowish; specimens about 45 mm. and longer usually with a vertically elongate dusky bar on each scale, these dusky bars may be much darker on middle of sides in certain areas to form broad barlike markings; belly plain pale; caudal, pelvics, and pectoral fins plain pale; dorsal base of pectoral fin with black spot; beginning in axil of pectoral an oblique dusky bar that extends behind pelvic base; a blackish peduncular spot occurs above lateral line, and 1 or 2 more may occur, anterior most on the fifth and sixth lateral line scales, (another indistinctly visible on an occasional specimen (1 specimen among all listed above) just below eleventh or twelfth lateral line scales); dorsal part of head blackish to light dusky; abruptly whitish ventrally from corner of mouth along a line a little below eye; dusky areas on rear of opercle, on subopercle, front of isthmus, and adjoining area; lips whitish, lower jaw whitish.

Color when alive.—Background coloration light bluish-green to light yellowish; dusky bars on each scale bluish, except some of those near head, which may have pink centers bordered with blue; dusky bar below pectoral composed of bluish scales or blue-bordered pink scales; head greenish with pinkish or bluish bands or streaks of characteristic shape; one from tip of snout below eye curving across opercle thence downward and forward to isthmus, this streak irregular and somewhat broken into separate parts; caudal, pectoral and pelvic fins light yellowish; dorsal and anal fins yellowish with 2 pinkish lengthwise streaks in dorsal and one in anal fins; eye orange to yellowish.

Ecology.—This is one of the most abundant species of fishes living in the coral-algae reefs of the tidal zone and to depths of at least 45 feet.

Remarks.—The figure of *trimaculata* by Quoy and Gaimard shows 3 black spots on upper part of body, whereas Bleeker's figure shows two dark spots, one at about fifth or sixth lateral line scale and the other on dorsal part of caudal peduncle, just behind rear of base of soft dorsal. The third spot, just below lateral line and about halfway between the other two, occurs occasionally in preserved specimens. Anterior and posterior dark spots occur frequently. The peduncular dark spot is of regular occurrence.

HALICHOERES MARGARITACEUS (Cuvier and Valenciennes)

FIGURE 103; PLATE 102,D

Julis margaritaceus CUVIER and VALENCIENNES, Histoire naturelle des poissons, vol. 13, p. 484, 1839 (type locality, Vanicolo).

Platyglossus opercularis GÜNTHER, Catalogue of the fishes in the British Museum, vol. 4, p. 148, 1862 (type locality, Fiji and Amboina); *in* Playfair and Günther, The fishes of Zanzibar, p. 95, pl. 12, fig. 1, 1866 (Johanna Island).

Halichoeres daedalma JORDAN and SEALE, Bull. U. S. Bur. Fish., vol. 25 (1905), p. 301, pl. 47, fig. 2 (male), 1906 (type locality, Apia and Pago Pago, Samoa).

Halichoeres opercularis SEALE, Occ. Pap., Bishop Mus., vol. 1, No. 3, p. 89, 1901 (Guam).—JORDAN and SEALE, Bull. U. S. Bur. Fish., vol. 25 (1905), p. 302, pl. 47, fig. 3 (female), 1906 (Apia and Pago Pago).

Halichoeres nafae TANAKA, Journ. College Sci. Imp. Univ. Tokyo, vol. 23, No. 7, p. 36, pl. 2, fig. 3, 1908 (type locality, Misaki, Japan).

Halichoeres poecilia BLEEKER, Atlas ichthyologique . . . , vol. 1, pl. 39, fig. 4, 1862.

Halichoeres nebulosus (Non Cuvier and Valenciennes) SEALE, Occ. Pap. Bishop Mus., vol. 1, No. 3, p. 88, 1901 (Guam).

SPECIMENS STUDIED

Bikini Atoll: 15 stations, 152 specimens, 20 to 100 mm. in standard length.
Eniwetok Atoll: 4 stations, 15 specimens, 35 to 89 mm.
Rongelap Atoll: 4 stations, 36 specimens, 18 to 79 mm.
Rongerik Atoll: 3 stations, 10 specimens, 22 to 76 mm.
Kwajalein Atoll: 1 station, 9 specimens, 45 to 74 mm.
Guam: 12 lots, 116 specimens, 20 to 72 mm.
Rota: 1 lot, 18 specimens, 43 to 80 mm.

Description.—Certain counts are recorded in table 105.

Pores in lateral line 20+2+5, gill rakers usually about 8+1+9 to 11.

Head 2.5 to 3.0; greatest depth 3.0 to 3.3; longest pectoral ray 4.5 to 4.6; snout tip to anus 1.8; snout to dorsal origin 2.7 to 3.0; all in standard length. Snout 2.5 to 3.2; eye 3.3 to 5.5; postorbital length of head 2.0; interorbital space 4.8 to 5.0; longest pectoral ray 1.7 to

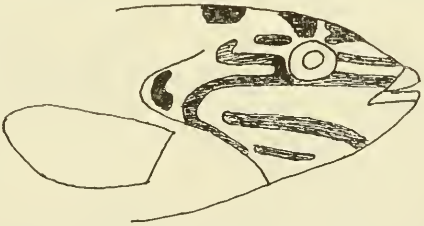

FIGURE 103.—Sketch by author of color pattern of head of *Halichoeres margaritaceus* (Cuvier and Valenciennes).

1.8; least depth of body 2.2 to 2.5; all in length of head. Distance between anterior and posterior nasal openings 4 to 8 in snout. Eye 0.5 to 1.1 in interorbital space.

Dorsal profile of head forming an angle of 65 to 70 degrees with ventral contour of head; pectoral fin reaching to opposite about tenth lateral line pore; pelvics with outer rays elongate, reaching to or nearly to anus; distal margin of caudal fin rounded to truncate.

Color in alcohol.—Background coloration whitish; dorsal fin more or less transversely barred, sometimes these bars interconnect to enclose roundish white spots; a black ocellate spot occurs between the first to third soft dorsal rays, this black spot is closer to distal edge of fin than the base; caudal fin plain pale, or with indistinct bars; sometimes these bars interconnect to enclose roundish white spots; a black spot, as small as or smaller than pupil occurs between the first and second dorsal spines, occasionally this spot extends a trifle on the membrane between the second and third spines. A specimen 20 mm. in standard length has traces of 3 dusky blotches on sides and the two dorsal dark spots are present; body otherwise pale except for a short dusky bar behind orbit; pelvic and pectoral fins plain pale or whitish.

The color markings on the head are as illustrated in figure 103. The chief characteristics of these markings are: (1) the long dark streak across cheek; (2) the dark bar just below streak (1), curving ventrally on opercle between black opercular spot and the rear end of the streak (1) on cheek; (3) the characteristically shaped blackish bar just behind eye; (4) characteristic pattern of dark areas on dorsal surface of head. A white bar occurs on base of pectoral, and another bar in axil of pectoral extending from below black opercular spot and ending in a point just below axil; sometimes 3 narrow white bars are visible on lower sides under pectoral fin, these occur on rows of scales at eighth, ninth and twelfth lateral-line pores.

On males, some of the scales on sides and back have the central basal part dark brownish, distal half whitish, the dark spots arranged in patches to form 4 or 5 blotches along sides and back; anal fin of adults 60 mm. and longer with a pale or white band through middle third, distal third dusky, basal third dusky, with whitish round area on each interradial membrane.

On females, the darkish areas on scales are arranged so that a reticulated pattern occurs, giving the appearance of white spots surrounded by darkish, these following the lengthwise rows of scales; the darkish pigment is intensified in certain areas to form about 4 or 5 darkish blotches as in males; lower sides whitish or pale; anal fin plain pale or whitish, the narrow reddish bars occurring in living specimens disappear completely in alcohol.

The smallest specimens listed do not have any black spots on caudal peduncle, nor on base of caudal fin or basally on soft rays of anal or dorsal fins.

Color when alive.—Based on kodachrome picture of female: Background coloration light olive; dark areas on scales blackish to dark brownish; dorsal fin barred with brownish red; black spot in soft dorsal surrounded by a white band; caudal fin yellowish, narrowly barred with brownish red; anal fins with barred alternating narrow red and yellow bars, the red bars surrounded with a light bluish tinge; dark spots behind eye and on opercle surrounded with brownish red; dark streaks radiating from eye brownish, bordered with bluish and dark brown edges, band below eye light pinkish, surrounding the light brownish streak across cheek; snout pinkish.

Ecology.—This labrid was observed in considerable abundance in the intertidal area of the reefs where ample growths of corals and algae occurred, as well as at depths to 45 feet.

Remarks.—This is a small species of labrid and in our collections specimens as large as 100 mm. in standard length are rare. The sexual dimorphism in regard to color pattern is distinct, as illustrated in the photographs. Mature or nearly mature eggs were observed in specimens as short as 50 mm.

The best characters for recognition of this species are (1) the light and dark streaks on the head, (2) ocellate dark spot on soft dorsal notably nearer distal edge of fin than its base, (3) anal fin not barred with brown dots as in *H. miniatus* (Cuvier and Valenciennes), and (4) pectoral rays usually ii,11.

HALICHOERES BIOCELLATUS, new species

FIGURE 104

Holotype.—USNM 112940, Bikini Atoll, Arji Island, lagoon, depth 20 to 40 feet, August 7, 1946, S–46–308, Brock and Herald, 1 specimen, 63 mm.

Paratypes.—Bikini Island, July 24, 1947, Univ. Washington, 1 specimen, 73 mm.; Rongelap Atoll; USNM 112941, Lomuilal Island, west side, lagoon reef, August 1, 1946, S–46–306, Herald, 1 specimen, 31.5 mm.; USNM 112942. Johnston Island, northern ocean reef, August 28–29, 1947, Schultz, 1 specimen, 41 mm.

Description.—In all the type specimens, the fin-ray counts are: Dorsal IX,12; anal III,12; pectoral ii,11. Pores in lateral line 20+2+5, with 2 rows above lateral line and 9 below it to anus.

Precision measurements were made on the holotype, and paratypes and these data are recorded in thousandths of the standard length, respectively. Standard length in mm. 63, 73, 41 and 31.5.

Length of head 310; 318; 349; 375. Greatest depth 333; 329; 298; 336. Least depth of caudal peduncle 165; 153; 158; 159. Length of snout 102; 107; 98; 102. Least width of interorbital space 75; 81; 90; 89. Postorbital length of head 154; 156; 171; 178. Snout tip to anus 594; 534; 536; 564; and to dorsal origin 310; 340; 361; 384. Longest fin ray: pectoral 214; 199; 205; 216; pelvic 187; 181; 159; 152; second anal spine 79; 82; 90; 133; caudal 249; 253; 229; 254; soft dorsal 143; 144; 134; 127; and soft anal 143; 137; 110; 127. Length of first dorsal spine 60; 60; 59; 44; and of last dorsal spine 132; 112; 110; and 133. Least preorbital width 54; 52; 41; 44.

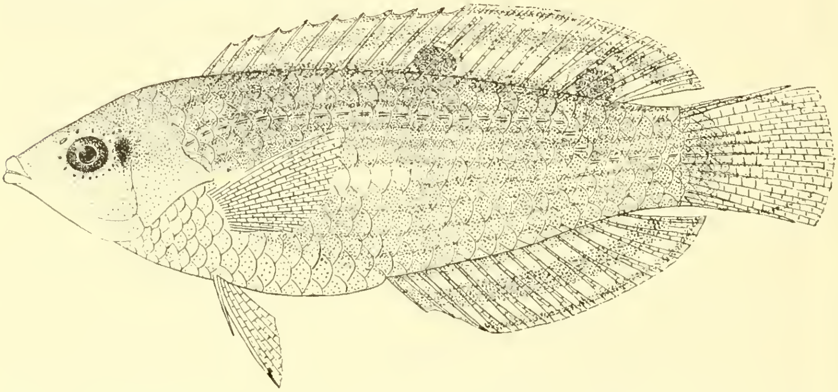

FIGURE 104.—*Halichoeres biocellatus*, new species, holotype, USNM 112940, from Bikini Atoll. Drawn by A. M. Awl.

Head 2.9 to 3.2; greatest depth 2.9 to 3.2; longest pectoral ray 4.2 to 5.0; snout tip to anus 1.7 to 1.8; snout tip to dorsal origin 2.7 to 3.2; all in standard length. Snout 2.9 to 3.5; eye 3.3 to 4.7; postorbital length of head 2.0 to 2.1; interorbital space 3.9 to 4.7; longest pectoral ray 1.4 to 1.7; least depth of body 2.0 to 2.3; all in length of head. Distance between anterior and posterior nasal openings 5 to 7 in snout. Eye 0.8 to 1.2 in interorbital space.

Dorsal profile of head forming an angle of 55 to 65 degrees with ventral contour of head; pectoral fin reaches to opposite ninth or tenth lateral line pore; pelvics with outer rays elongated reaching two-thirds to three-fourths the way to anus.

Color in alcohol.—Background coloration light brownish to brownish, with head and anteroventral part of body pale or whitish; ventrally body is pale on two smallest specimens; a narrow pale median streak on body extending to caudal fin, this streak is broad on the two largest specimens and extends from behind head to middle of length, where it changes to brown of body; largest specimen has two dusky streaks near ventral part of pectoral base that extend posteroventrally a short distance; dusky bar behind eye prominent; the most characteristic mark are two ocellate black spots in the soft dorsal fin, the first mostly between soft rays 1 to 3, and the second between soft rays 9 to 11; the rest of the dorsal fin is marked with pale and dusky area; in the largest specimen the black ocellate spots are less distinct than in the others and might disappear on still larger specimens. The smallest specimen has, in addition to the median streak, 2 pale streaks above it and two below. The anal fin has a median dusky streak, then distally the edge is pale with a submarginal dusky line.

Color when alive.—Pale areas yellowish.

Remarks.—This new species differs from all other species referred to the genus *Halichoeres* in having 2 ocellate spots in the soft dorsal fin. It is distinguished from them in the key, page 224.

Named *biocellatus* in reference to the 2 ocellate spots in the soft dorsal fin.

HALICHOERES HOEVENI (Bleeker)

PLATE 106,B

Julis (*Halichoeres*) *hoevenii* BLEEKER, Nat. Tijdschr. Nederl.-Indië, vol. 2, p. 250, 1851 (type locality, Neira, Banda).

Platyglossus hoevenii BLEEKER, Atlas ichthyologique . . ., vol. 1, p. 111, pl. 42. fig. 3, 1862 (Java, Bawean, Sumatra, Nias, Banka, Solo, Ternate, Buru, Amboina, Haruko, Guam, Goram, Banda).

SPECIMENS STUDIED

Bikini Atoll: Amen Island, lagoon, depth 30 feet, August 4, 1946, S–46–308, Herald and Brock, 3 specimens, 41 to 46 mm.

Likiep Atoll: Likiep Island, August 22, 1949, Univ. Washington, 11 specimens, 44 to 67 mm.

Description.—Certain counts are recorded in table 105.

Head 3.0 to 3.2; greatest depth 3.1 to 3.4; longest pectoral ray 5.3 to 5.6; snout tip to anus 1.7 to 1.8; snout tip to dorsal origin 2.9 to 3.1; all in standard length. Snout 3.1 to 3.2; eye 3.9 to 4.5; postorbital length of head 2.1 to 2.2; interorbital space 4.0 to 4.1; longest pectoral ray 1.6 to 1.7; least depth of body 2.0 to 2.1; all in length of head. Distance between anterior and posterior nasal openings 5 to 6 in snout. Eye 0.9 to 1.1 in interorbital space.

Dorsal profile of head forming an angle of 60 to 65 degrees with ventral contour of head; pectoral fin reaches to opposite eighth or ninth lateral line pore; pelvics with outer rays elongate, extending from half to three fourths way to anus; distal margin of caudal fin rounded to nearly truncate.

Color in alcohol.—Background coloration light tan or whitish; 10 to 12 alternating whitish and brownish streaks on body and on head, usually brownish streaks are as wide or wider than whitish ones; black spot basally between dorsal spines I and II; an ocellate black spot in basal half of soft dorsal between rays 1 to 4, often confined to rays 2 and 3; a blackish ocellate spot on caudal fin base about halfway between lateral line and the dorsal edge; a short darkish bar just behind the eye; soft dorsal and anal fins with alternating dusky and whitish streaks; a dark spot at dorsal edge of pectoral fin base and a small dark spot in front of eye on side of snout variably present or absent; paired fins and caudal fin plain pale or whitish.

HALICHOERES KALLOCHROMA (Bleeker)

PLATE 104,D

Julis (*Halichoeres*) *kallochroma* BLEEKER, Nat. Tijdschr. Nederl.-Indië, vol. 4, p. 289, 1858 (type locality, Priaman, Sumatra).

Platyglossus kallochroma BLEEKER, Atlas ichthyologique . . ., vol. 1, p. 108, pl. 42, fig. 4, 1862 (Sumatra and Nias).

Platyglossus flos-corallis JORDAN and SEALE, Bull. U. S. Bur. Fish. vol. 25 (1905), p. 299, pl. 46, fig. 2, 1906 (holotype USNM 51744, Pago Pago, Samoa).

SPECIMENS STUDIED

Eniwetok Atoll: Eniwetok Island, July 27, 1948, Univ. Washington, 1 specimen, 66 mm.

Likiep Atoll: Likiep Island, August 22, 1949, U. Washington, 1 specimen, 60 mm.

Description.—Certain counts are recorded in table 105.

Head 3.0 to 3.2; greatest depth 3.2 to 3.3; longest pectoral ray 5.5 to 5.6; snout tip to anus 1.7, to dorsal origin 2.7 to 3.0; all in standard length. Snout 2.8 to 3.0, eye 4.5 to 4.8; postorbital length of head 2.0 to 2.1; interorbital space 4.2 to 4.3; longest pectoral ray 1.6 to 1.7; least depth of body 2.1; all in length of head. Distance between anterior and posterior nasal openings 5 to 6 in snout. Eye 1.0 to 1.2 in interorbital space.

Dorsal profile of head forming an angle of 60 to 65 degrees with ventral contour of head; pectoral fin reaches to opposite eighth or ninth lateral line pore; pelvics with outer rays greatly elongated, reaching nearly to or to anus; distal margin of caudal fin rounded.

Color in alcohol.—Background coloration light tan or whitish; about 10 to 12 alternating whitish and brownish streaks on body, some of these continued on head; the brown streaks a little wider than the white one; dorsal fin without any black spots, or ocellate spots; base of caudal fin with or without blackish spot, when present this spot occurs about halfway between lateral line and dorsal edge of caudal fin base; dorsal and anal fins with alternating dusky and light streaks; dorsal basal edge of pectoral fin with a black spot; outer or elongated rays of pelvics dusky; distal third of caudal fin blackish with distal edge whitish, the dark portion with rounded lighter areas; in both of

Marshall Islands specimens the streaks behind the pectoral fin are faint and a blackish blotch occurs in the axil of pectoral.

HALICHOERES MARGINATUS Rüppell

Plate 105,A-C

Halichoeres marginatus Rüppell, Neue Wirbelthiere zu der Fauna von Abysinnien gehörig, Fische, p. 16, 1835 (type locality, Red Sea).

Platyglossus marginatus Bleeker, Atlas ichthyologique . . . , vol. 1, p. 109, pl. 41, fig. 3, 1862 (Java, Sumatra, Batu, Amboina).—Günther, Journ. Mus. Godeffroy, vol. 8, No. 16, p. 271, pl. 143, fig. 3, 1909 (Society Islands; Samoa).

Julis notopsis Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 13, p. 485, 1839 (type locality, Guam).

Platyglossus notopsis Bleeker, Atlas ichthyologique . . . , vol. 1, p. 111, pl. 41, figs. 1, 1862 (Java, Bawean, Sumatra, Batu, Biliton, Celebes).

Platyglossus notopsis (non Kuhl and Van Hasselt) Fowler, Proc. Acad. Nat. Sci. Philadelphia, vol. 98, p. 167, fig. 35, 1946 (Riu Kiu Islands).

SPECIMENS STUDIED

Bikini Atoll: 22 stations, 55 specimens, 19 to 120 mm. in standard length.
Eniwetok Atoll: 7 stations, 14 specimens, 17 to 105 mm.
Rongerik Atoll: 4 stations, 5 specimens, 23 to 72 mm.
Rongelap Atoll: 7 stations, 7 specimens, 9 to 50 mm.
Guam: 3 lots, 14 specimens, 39 to 71 mm.
Rota: 1 lot, 1 specimen, 44 mm.

Description.—Certain counts are recorded in table 105.

Head 2.7 to 3.7; greatest depth 2.5 to 2.8; longest pectoral ray 4.3 to 4.5; snout tip to anus 1.8 to 2.0; to dorsal origin 2.3 to 3.5; all in standard length. Snout 2.8 to 3.6; eye 3.1 to 5.3; postorbital length of head 1.9 to 2.1; interorbital space 3.6 to 4.0; longest pectoral ray 1.3 to 1.9; least depth of body 1.6 to 2.0; all in length of head. Distance between anterior and posterior nasal openings 3.5 to 7.0 in snout. Eye 0.7 to 1.5 in interorbital space.

Dorsal profile of head forming an angle of 55 degrees in young to 75 degrees in adults with ventral contour of head; pectoral fin reaches to opposite ninth to eleventh lateral line pore; pelvics with outer rays longest reaching to or past anus but only two-thirds the way to anus in the young; distal margin of caudal fin rounded.

Color in alcohol.—Adult background coloration blackish or dark brown, with center of each scale darker; dorsal and anal fins blackish with numerous light spots; margin of these fins white; pectoral fin blackish basally paler distally, each ray blackish; pelvics dark brownish or blackish; caudal fin black basally (scaled portion only), then central portion abruptly whitish with a broad blackish new-moon-shaped cross bar bordered by whitish, this black and white area reaching dorsal and ventral edges of fin near its midlength; the distal posterior half of caudal fin margin dusky.

The two smallest specimens, 74 and 81 mm., have 15 to 17 alternating pale and dark brown streaks on the head, anterior part of body and dorsally along upper sides and back; posteroventrally the light streaks fade into the general brownish color. The streaks on the head are irregular.

Background coloration of young brown to dark brown with few to numerous alternating pale and dark streaks mostly on head in larger ones and on head and on body in small young; dorsal and anal fins blackish or brownish, always darker in color than brownish body; dorsal and anal fins barred or mottled with darker shades; a small black ocellate spot basally between dorsal spines I and II, a second black ocellate spot between soft dorsal rays 2 to 5, this spot sometimes extending a little beyond rays 2 and 5; pectoral fin whitish; pelvics brownish; caudal fin varying from whitish in small ones, to dusky or blackish in larger young, the distal edge of caudal fin narrowly edged with whitish.

There is considerable variation in the number of pale and dark streaks from young to adult. From 16 to 25 mm. in standard length, 6 or 7 alternating pale and dark brown streaks occur on head and body; 4 brown ones on dorsal surface of head; 2 from behind eye; 1 below eye through pectoral base, 1 below pectoral, and 2 on ventral surface of breast in front of pelvics. At 28 mm. the same brown and pale streaks occur, except that the center of each brown streak is somewhat paler. Between lengths of 36 to 39 mm. the pale interspaces become narrower and the pale centers of the brown streaks wider and more prominent; however, some specimens between 32 and 37 mm. retain the juvenile color pattern; whereas between 35 and 40 mm. the number of alternating pale and brown streaks number 12 to 15 on the head and begin to disappear posteriorly on the body, the caudal fin is white, becoming abruptly dark brown basally. On larger sizes the pale and dark streaks may be discernible only on the head, and dorsally on the body.

Remarks.—This species is recognizable by its deep body, dark brownish coloration with pale and dark streaks in combination with the large ocellate spot between the second to fifth soft dorsal rays, and whitish to dusky caudal fin.

The adult, which is uncommon, differs from the young in lacking ocellate spots; it has instead a blackish new-moon-shaped cross bar in middle of caudal fin.

Randall, while studying fishes in the U. S. National Museum in December 1954, pointed out to me the probability that *notopsis* of Cuvier and Valenciennes represents the young of *H. marginatus;* in this opinion I agree.

Family SCARIDAE: Parrotfishes

By Leonard P. Schultz

This family may be recognized by the following combination of characters: Teeth coalesced, forming two dental plates in each jaw, each pair separated at the middle by a suture; externally canines or incisorlike teeth present or absent; gill membranes broadly joined to the isthmus, with or without a free fold across isthmus; scales on cheek in 1 to 4 rows; median predorsal scales 3 to 8; lateral line follows contour of back to below rear edge of base of dorsal fin then drops 1 or 2 scale rows, continuing along midaxis of caudal peduncle, the number of pores being rather constantly 17 to 20 in dorsal lateral line and 5 to 7 in peduncular lateral line (the usual number of pores is 18+5 or 6); dorsal rays IX,10; anal III,9, the anal spines slender, the first one weakly developed; pectoral rays ii,11 to ii,15; branched caudal rays 6+5; fins naked, except that basal part of median fins may have a row of scales; upper pharyngeal bones paired, each dentigerous surface with 1 to 3 rows of molarlike teeth; lower pharyngeal bone single, bearing rows of molarlike teeth; vertebrae always 25.

Since the family Scaridae was reviewed by me (U. S. Nat. Mus. Bull. 214, 1958) I am shortening this report by not duplicating here the material presented in that bulletin, except the generic and subgeneric keys and the family and subfamily diagnoses. The identification of species of parrotfishes is so difficult that to distinguish species one needs all the information presented in Bulletin 214, which includes a list of synonyms for each species and other important references.

Subsequent to publication of Bulletin 214 (see p. 48) it has been determined that *Scarus ovifrons* Temminck and Schlegel (Fauna japonica, poissons, p. 173, pl. 88, 1846, type locality, Japan) should replace *Scarus oedema* (Snyder), the latter being a synonym of S. *ovifrons*.

KEY TO THE GENERA AND SUBGENERA OF SCARIDAE

1*a*. Cheek with 2 to 4 (4 in one Atlantic species) rows of scales below eye, second row may be represented by one scale; teeth fully coalesced into a parrotlike beak, with median suture at symphysis of each jaw; edge of dental plate of lower jaw included in that of upper jaw when mouth is closed; pectoral rays normally ii,12 to ii,15; dentigerous surface of lower pharyngeals longer than broad; gill membranes broadly joined to isthmus without a free fold across isthmus. Subfamily Scarinae.

2*a*. Each upper pharyngeal bone (pl. 108, D) with a single enlarged row of teeth, no rudimentary row along base of the enlarged row except on small specimens of subgenus *Xenoscarops;* gill rakers of first gill arch 6 to 21+21 to 38. (Indo-Pacific.)------Genus **Scarops** Schultz

3*a*. Three rows of scales on cheek. (East, Central, and West Pacific.)
Subgenus **Scarops** Schultz

3*b*. Two rows of scales on cheek. (East Pacific.)
Subgenus **Xenoscarops** Schultz

2*b*. Each upper pharyngeal bone (pl. 108, A, B) with two enlarged rows of teeth, and along the outer base of the outer enlarged row occurs a rudimentary row; 3 rows of scales on cheek; gill rakers 4 to 9+11 to 15. (Indo-Pacific.)___________Genus **Chlorurus** Swainson (p. 242)

2*c*. Each upper pharyngeal bone (pl. 108, E) with a single enlarged row of teeth, and along the outer base of this row occurs a rudimentary row; 2 to 4 rows of scales on cheek; gill rakers 12 to 30+25 to 40. (Atlantic; Indo-Pacific.)____________Genus **Scarus** Forskål (p. 243)

4*a*. Median predorsal scales 3. (West Pacific.)
Subgenus **Ypsiscarus** Schultz

4*b*. Median predorsal scales 4. (Central and West Pacific, Indian Ocean.)
Subgenus **Scarus** Forskål

4*c*. Median predorsal scales 5 to 8. (Atlantic, Pacific, Indian Ocean.)
Subgenus **Hemistoma** Swainson

1*b*. Check below eye with 3 to 6 scales in a single row; front edge of dental plate of upper jaw included within that of lower jaw when mouth is closed, or edges of the dental plates oppose each other; teeth more or less coalesced into a parrotlike beak or some of the teeth making up edge of dental plate with free or almost free or distinct edges, or there may be present externally pointed incisorlike teeth more or less imbricated and in rows; pectoral fin rays ii,11; gill rakers coarse, 2 or 3+1+6 to 12, the raker at angle of arch may be difficult to distinguish from those on ventral part of arch; upper pharyngeal bones with 3 rows of teeth on each side, plate 108; dentigerous surface of lower pharyngeals broader than long. Subfamily SPARISOMATINAE.

5*a*. Median predorsal scales 4.

6*a*. Gill membranes broadly joined to isthmus, without a free fold across isthmus.

7*a*. Dorsal spines pungent.

8*a*. Free, imbricate, incisorlike teeth present externally on both jaws; inner lip not free at symphysis. (Hawaiian Islands.)
Genus **Scaridea** Jenkins

8*b*. No free, imbricate incisorlike teeth present externally on lower jaw, teeth coalesced into a beak much as in the Scarinae, but edges of the dental plates have more distinct but fused teeth; when mouth is closed, edge of dental plate of upper jaw included within that of lower jaw; inner lip free across snout; anterior nasal opening with a cirrus, multifid at tip; canine teeth usually present on upper jaw. (Atlantic.)
Genus **Sparisoma** Swainson

7*b*. Dorsal spines flexible.

9*a*. Free, imbricate, incisorlike teeth present externally on both jaws; 6 or 7 teeth in the middle rows of lower pharyngeals (pl. 108, C), the seventh or outer tooth usually rudimentary; inner upper lip not free across symphysis of snout; upper jaw with canines at sides hooked out and somewhat backward. (Central and West-Pacific, Indian Ocean.)
Genus **Calotomus** Gilbert

9*b*. No free, imbricate, incisorlike teeth present externally on jaws; teeth coalesced into a plate with external canines on upper jaw of adult males, absent on young and absent on adult females. 6 teeth present in middle rows of lower pharyngeals (pl. 108, F), the outer one on one side or the other rudimentary; lower jaw fits over tips of teeth of upper jaw when mouth is closed. (West Pacific, Indian Ocean.)---Genus **Leptoscarus** Swainson

6*b*. Gill membranes broadly jointed to isthmus, with a free fold (sometimes very narrow) across isthmus; dorsal spines flexible; pointed, incisorlike teeth present externally on both jaws; canines on outside of upper jaw present or absent.

10*a*. Dermal cirrus absent on anterior nostril, edge mostly in the form of an elevated or raised rim; inner lip not free at front of snout; head notably pointed from lateral profile, angle between dorsal and ventral profiles about 40 to 50 degrees, snout profile may be slightly concave; external teeth slanting forward at front of both jaws, those of lower jaw more slanting; when mouth is closed tips of upper jaw meet teeth of lower jaw obliquely. (West Atlantic, Bermuda.)---------------Genus **Cryptotomus** Cope

10*b*. Dermal cirrus on anterior nostril well developed but usually not reaching posterior nostril; inner lip free across tip of snout; head more rounded, becoming somewhat pointed in adults, angle between dorsal and ventral profiles about 70 to 80 degrees; tips of external teeth at front of mouth meeting, or those of lower jaw may be included; not notably oblique. (West Atlantic, East Pacific.)---------------------------Genus **Nicholsina** Fowler

5*b*. Median predorsal scales 5; gill membranes broadly joined to isthmus; without free fold; dorsal spines pungent; no free imbricate teeth present on jaws; edge of upper jaw included in that of lower jaw when mouth is closed. (East Atlantic.)
Genus **Euscarus** Jordan and Evermann

Subfamily SCARINAE

This subfamily is characterized by having the teeth fully coalesced into plates with a median suture, and the tip of lower jaw enclosed in upper jaw when mouth is closed; rows of scales on the cheek number 2 to 4, ventral row may be represented by one to several scales; upper pharyngeal bones with 1 to 3 rows of teeth, the outer or third row if present, rudimentary; lower pharyngeals with dentigerous surface notably longer than broad, with concave or flat surface; number of teeth in middle rows of lower pharyngeals 5, usually with outer tooth on one side reduced in size; if canines are present at side of jaws they are always behind middle of side of dental plate; anterior nostril without a dermal cirrus, or at most only a slightly raised rim; lateral line interrupted below rear end of base of dorsal fin, beginning again on second scale row below and extending along midbase of caudal peduncle; gill rakers on first gill arch vary from about 4 to 30 + 11 to 40; pectoral rays normally ii,12 to ii,15; dorsal spines flexible; median predorsal scales 3 to 9; abdominal vertebrae 10 to 12, and caudal vertebrae 13 to 15, always totaling 25.

Genus CHLORURUS Swainson

Chlorurus Swainson, Natural history and classifications of fishes . . ., vol. 2, p. 227, fig. 61, 1839 (monotypic, *Scarus gibbus* Rüppell; also as *Chloregaster* Swainson on p. 172 with no species listed and under the subfamily Labrinae as *Chlorurus* with no species listed, also another error).

CHLORURUS BICOLOR (Rüppell)

Plates 108,A; 109,A

Scarus bicolor Rüppell, Atlas zu der Reise im Nördlichen Afrika . . . Fische des rothen Meers, p. 82, pl. 21, 1828 (type locality, Djedda).

SPECIMENS STUDIED

Bikini Atoll: 6 stations, 9 specimens, 127 to 270 mm. in standard length; 1 lot, Univ. Washington, 1 specimen, 200 mm.

Rongerik Atoll: 1 station, 1 specimen, 40 mm.

Rongelap Atoll: 4 stations, 4 specimens, 26 to 435 mm.

Arno Atoll: 1 lot, 1 specimen 98 mm.

Likiep Atoll: 1 lot, Univ. Washington, 1 specimen, 55 mm.

Ecology.—The juveniles of this species occurred occasionally in the shallow tidal zone of the reefs, whereas the adults were taken below the low tidal level. At no time did this species appear to be an abundant inhabitant of the reefs.

Remarks.—This species is characteristically colored at all sizes. The young have a dark ocellate spot at the front part of the dorsal fin and the larger fishes have black spots on the lower scales of the body. The median predorsal scales number 6 or 7; there are 3 rows of scales on the cheek, with 4 to 8 scales in the ventral (third) row; and there are usually ii,12 pectoral fin rays.

CHLORURUS PULCHELLUS (Rüppell)

Plates 108,B; 109,B

Scarus pulchellus Rüppell, Neue Wirbelthiere zu der Fauna von Abysinnien gehörig, Fische p. 25, pl. 8, fig. 3, 1835 (type locality, Red Sea).

SPECIMENS STUDIED

Bikini Atoll: Lagoon, 4 miles Southwest of Bikini Island, July 11, 1946, S–46–247, 1 specimen, 375 mm.

One large specimen taken at Enyu Island in 1946, was photographed but not preserved.

Rongelap Atoll: Tufa Island, July 18, 1946, 1 specimen, 355 mm.

Ecology.—This characteristic species was never seen over the intertidel zone of the reef, but it did occur in the deeper waters of the lagoon and along the deeper waters of the ocean side of the reefs. The smallest specimen seen by me was about a foot long.

Remarks.—This species is distinguished by its characteristic color pattern; the small number of gill rakers, about 6 or 7 + 12 to 15, totaling about 20 to 23; the 3 rows of teeth on each upper pharyngeal bone; the 3 rows of scales on the cheek, with 5 or 6 scales in the ventral (third) row; 5 or 6 median predorsal scales, and ii,12 pectoral fin rays.

Genus SCARUS Forskål

Scarus Forskål, Descriptiones animalium . . . , p. 25, 1775 (type species designated as *Scarus psittacus*[58] (not of Linnaeus) Forskål = *Scarus harid* Forskål by Jordan and Gilbert, U. S. Nat. Mus. Bull. 16, p. 938, 1882; and by Swain, Proc. Acad. Nat. Sci. Philadelphia, p. 274, 1882).

Subgenus SCARUS Forskål

SCARUS MICRORHINOS Bleeker

Scarus microrhinos Bleeker, Nat. Tijdschr. Nederl.-Indië, vol. 6, p. 200, 1854 (type locality, Batavia, Java, type examined in British Museum, Cat. No. 1862.2.28.54, standard length 300 mm.)

SPECIMENS STUDIED

Bikini Atoll: 13 stations, 22 specimens, 60 to 450 mm. in standard length.
Rongelap Atoll: 5 stations, 16 specimens, 25 to 250 mm.
Eniwetok Atoll: 2 stations, 13 specimens, 100 to 240 mm.
Rongerik Atoll: 3 stations, 7 specimens, 91 to 156 mm.

Ecology.—This green parrotfish was one of the most abundant species on the outer margins of the reefs and in the lagoon where it was frequently taken or observed at depths of 10 to 25 feet or more.

Remarks.—This species may be recognized by its 4 median predorsal scales, 3 rows of scales on the cheek, with 3 to 8 scales in the ventral row; usually ii,14 or ii,15 pectoral rays; and by its green color in conjunction with a protruding forehead on the adult, lower part of the head light green as contrasted with a darker coloration dorsally, and the green band on head extending from mouth to pectoral fin base.

SCARUS HARID Forskål

Scarus harid Forskål, Descriptiones animalium, pp. X,30, 1775 (type locality, Arabia).

SPECIMENS STUDIED

Bikini Atoll: 3 stations, 4 specimens, 180 to 305 mm. in standard length.
Rongelap Atoll: 1 station, 1 specimen, 49 mm.
Arno Atoll: 1 lot, 1 specimen, 202 mm.
Guam: 1 lot, 1 specimen, 265 mm.
Saipan: 1 lot, 1 specimen, 310 mm.

Remarks.—This species may be recognized by having 4 median predorsal scales, 3 rows of scales on the cheek, with 3 to 5 scales in the ventral row, usually ii,13 pectoral rays; white teeth covered by the lips; a broad preorbital distance, 2.5 to 3.1 times in head; and a broad naked space below the eye. Another characteristic is the concave space just in front of the eyes, which gives the snout a more or less narrow, or pointed, profile when viewed from a dorsal aspect.

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[58] *Scarus psittacus* Forskål from the Red Sea is a different species than *Coryphaena psittacus* Linnaeus, a labrid from the Atlantic. Among parrotfishes *Scarus psittacus* Forskål has been confused with "*Scarus psittacus* (Linnaeus)."

SCARUS LUNULA (Snyder)

Callyodon lunula Snyder, Proc. U. S. Nat. Mus., vol. 35, p. 99, 1908 (type locality, Naha, Okinawa; holotype USNM 62236); Proc. U. S. Nat. Mus., vol. 42, p. 509, pl. 66, fig. 2, 1913.

SPECIMENS STUDIED

Bikini Atoll, lagoon 4 miles southwest of Bikini Island, spearing over submerged coral head, depth 45 feet, July 11, 1946, Brock, Herald and Kohler, S-46-247, 1 specimen, 270 mm.

Ecology.—This rare species was captured but once by spearing in about 40 feet of water over a coral head 4 miles southwest of Bikini Island in the lagoon. It seems to be rare in the northern Marshall Islands and probably was not distinguished from other species when collected.

Remarks.—This species is distinguished by 4 median predorsal scales, 3 rows of scales on the cheek, with 2 or 3 scales in the ventral row; ii,12 pectoral fin rays, white teeth, and by its coloration of three color streaks in the anal fin, edge of upper lip green, then pink, then a green streak from snout past lower edge of eye; especially notable is a green edge on operculum in front of pectoral fin base, and one or two green streaks connecting eyes across interorbital space. The dorsal part of body and the head is purplish brown. All of the specimens observed have a characteristic hump in front of and over the orbits.

SCARUS FORMOSUS Cuvier and Valenciennes

Scarus formosus Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 14, p. 283, 1839 (type locality, Sandwich Islands; type examined in Mus. Nat. Hist. Nat. Paris, No. 585).

SPECIMENS STUDIED

Bikini Atoll: Bikati, Makin, John Randall, 1 specimen, 160 mm.
Arji Island, August 7, 1946, S-46-308, 1 specimen, 52 mm.
In addition to the types several other specimens have been studied.

Remarks.—This species is characterized by having 4 median predorsal scales, usually with a pair in front of the anteriormost median scale, 3 rows of scales on the cheek with 1 or 2 scales in the ventral row; white teeth and ii,12 pectoral rays. The color pattern in region of pectoral, posterior part of head below and behind eye dull yellowish tan grading to yellow ventrally and yellow orange anteroventrally. Dorsal part of head bright green; upper lip yellowish green; irregular areas of turquoise blue on chin connecting with green snout; three blue spots on midventral line in front of pelvics; dorsal and anal fins, each with 3 color streaks (basally green, center orange, distally blue). The young of *S. formosus* have dark and light streaks on the sides of the body. In the adult the forehead is enlarged giving to the head a strongly convex dorsal contour.

SCARUS SCHLEGELI (Bleeker)

Pseudoscarus schlegeli BLEEKER, Versl. Akad. Wet. Amsterdam, vol. 12, p. 242, 1861 (type locality, Celebes); Atlas ichthyologique . . ., vol. 1, p. 48, pl. 12, fig. 2, 1862 (Celebes).

SPECIMENS STUDIED

Bikini Atoll: 3 stations, 5 specimens, 146 to 200 mm. in standard length; 1 lot, Univ. Washington, 1 specimen, 205 mm.

Rongerik Atoll: 2 stations, 3 specimens, 180 to 255 mm.

Remarks.—This species has been confused with *Scarus mutabilis*, *S. caudofasciatus*, and *S. zonularis*, all of which represent a single species. It is easily distinguished from these by having only 4 median predorsal scales and only 2 rows of scales on the cheek, whereas all others that have been confused with species with vertical dark bars have 5 or 6 median predorsal scales and 3 rows of scales on the cheek, except *S. venosus* Bleeker and *S. rhoduropterus* Bleeker, but the latter lacks a dark spot at base of upper pectoral rays and the lips are separated by an angle greater than 65 degrees. *S. venosus* differs in having 5 dark vertical bars. *S. schlegeli*, may be recognized by its coloration: A black spot at the base of the upper pectoral fin ray, under soft dorsal fin 2 broad dark bars separated by a light bar, and pale coloration anterior to the first dark bar.

SCARUS TAENIURUS Cuvier and Valenciennes

Scarus taeniurus CUVIER and VALENCIENNES, Histoire naturelle des poissons, vol. 14, p. 257, 1839 (type locality, Mauritius; type examined, Mus. Nat. Hist. Nat. Paris, No. 554)

SPECIMENS STUDIED

Bikini Atoll: 16 stations, 75 specimens, 24 to 190 mm. in standard length.
Rongelap Atoll: 6 stations, 10 specimens, 59 to 195 mm.
Rongerik Atoll: 3 stations, 8 specimens, 102 to 220 mm.
Eniwetok Atoll: 5 stations, 20 specimens, 69 to 151 mm.
Jaluit Atoll: 1 lot, 1 specimen, 128 mm.
Likiep Atoll: 1 lot, Univ. Washington, 1 specimen, 57 mm.
Guam: 4 lots, 31 specimens, 29 to 195 mm.
Rota: 1 lot, 1 specimen, 145 mm.
Saipan: 1 lot, 3 specimens, 145 to 225 mm.

Remarks.—*S. taeniurus* belongs in the group of parrotfishes with 2 rows of scales on its cheek, 4 median scales in front of dorsal origin, and the pectoral rays are usually ii,12, with occasional exceptions. It is characterized by a rounded caudal fin in the young, becoming at most truncate in adults, with the distal margin marked with a fine white line in alcoholic specimens of all sizes and not with a broad dusky margin as in *forsteri*. The black spot at base of upper pectoral rays is evident at all ages. The edges of both lips are dark in alcohol, not pale. In the brown phase a dark spot sometimes occurs basally between dorsal spines I and II.

Ecology.—The brown color phase is abundant on the shallow parts of the reefs.

SCARUS FORSTERI Cuvier and Valenciennes

Scarus forsteri Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 14, p. 275, 1839 (type locality, Tahiti).

SPECIMENS STUDIED

Bikini Atoll: 1 station, 1 specimen, 117 mm. in standard length.
Eniwetok Atoll: 2 stations, 2 specimens, 152 to 190 mm.
Jaluit Atoll: 1 lot, 1 specimen, 180 mm.
Arno Atoll: 1 lot, 1 specimen, 142 mm.
Guam: 1 lot, 5 specimens, 180 to 230 mm.
Saipan: 1 lot, 3 specimens, 200 to 260 mm.

Remarks.—This species may be recognized by a combination of characters: 4 median predorsal scales, 2 rows of scales on the cheek; pectoral rays usually ii,12; a black spot at base of pectoral, usually well developed; lips almost covering whitish teeth; canine teeth, usually numbering on upper jaw 1+1, 1+2 or 2+2, and on lower jaw 1+1 or 2+2; the important color marks are the green edges of the lips, the dark line submarginally along distal edge of caudal fin, and broad pale edge (green when alive) of anal fin, and the dorsal fin set off submarginally by a dark line.

SCARUS SORDIDUS Forskål

Scarus sordidus Forskål, Descriptiones animalium, pp. x, 30, 1775 (type locality, Arabia).

SPECIMENS STUDIED

Bikini Atoll. 22 stations, 226 specimens, 14.5 to 240 mm. in standard length; 1 lot, Univ. Washington, 5 specimens, 120 to 145 mm.
Rongelap Atoll: 10 stations, 133 specimens, 12 to 145 mm.
Rongerik Atoll: 4 stations, 19 specimens, 17 to 210 mm.
Eniwetok Atoll: 6 stations, 66 specimens, 41 to 185 mm.
Likiep Atoll: 1 lot, Univ. Washington, 23 specimens, 35 to 80 mm.
Guam: 4 lots, 34 specimens, 16 to 240 mm.
Rota: 1 lot, 1 specimen, 13 mm.
Saipan: 1 lot, 1 specimen, 180 mm.

Remarks.—This species is characterized by having 4 median predorsal scales, 2 rows of scales on the cheek; pectoral rays usually ii,13; teeth white in young, becoming green in adults in green color phase. The immature are brownish or reddish brown with a pale (pink when alive) caudal area in which is a roundish dark blotch at base of caudal fin; lips pale, yellowish to pink when alive. When it has attained the greenish stage of adult life the characteristic green and pinkish streaks or bands around the mouth are useful along with the broad green band distally on anal fin and narrow band distally on dorsal, as follows: Blue-green band above pale (pink when alive) edge of upper lip that extends to the eye; the broad green band on lower jaw just behind pale (pink when alive) edge of lower lip extends to eye, joining the green band from upper lip at corner of mouth, these green bands more or less fade posterioventrally without a distinct edge.

Ecology.—This parrotfish was the most abundant species in the intertidal zone of the reef and occurred at depths down to 45 feet, and probably deeper, but that zone was not investigated thoroughly. Wherever algae and coral grew, this species was found. The intestinal tract was filled with algal-coral debris.

SCARUS JONESI (Streets)

Pseudoscarus jonesi Streets, U. S. Nat. Mus. Bull. 7, p. 80, 1877 (type locality, Palmyra Island; 4 cotypes, USNM 19221).

SPECIMENS STUDIED

Bikini Atoll: 19 stations, 87 specimens, 19 to 330 mm. in standard length.
Eniwetok Atoll: 6 stations, 19 specimens, 77 to 375 mm.
Rongelap Atoll: 6 stations, 19 specimens, 19 to 134 mm.
Rongerik Atoll: 3 stations, 21 specimens, 95 to 300 mm.
Kwajalein Atoll: 1 station, 2 specimens, 18 and 19 mm.

Remarks.—This species is characterized by having 4 median predorsal scales, 2 rows of scales on cheeks, usually ii,13 pectoral rays, and characteristic green markings on front of head as shown in figure 12 of U. S. Nat. Mus. Bull. 214 (p. 39, 1958).

Subgenus HEMISTOMA Swainson

SCARUS GLOBICEPS Cuvier and Valenciennes

Scarus globiceps Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 14, p. 242, 1839 (type locality, Tahiti; type examined in Mus. Nat. Hist. Nat. Paris, No. 1732).

SPECIMENS STUDIED

Bikini Atoll: 2 stations, 2 specimens, 195 and 235 mm. in standard length.
Eniwetok Atoll: 1 station, 1 specimen, 185 mm.
Kwajalein Atoll: 1 lot, 1 specimen, 200 mm.

Remarks.—This species is characterized by having 5 or 6 median predorsal scales, 3 rows of scales on the cheek, usually with 2 or 3 in the ventral row, ii,12 pectoral fin rays, whitish teeth; tiny green (pale or dusky in alcohol) spots, usually a few to several on the anterodorsal part of the body, the black ocellate spot near the bases of dorsal spines III or IV may be lacking on large adults; the blackish pectoral base darker dorsally; the pale line from middle of snout to lower edge of eye, thence posteriorly, separates the pale color of lower part of head from the darker color dorsally; another pale streak forward from middle of eye to middle of snout.

Ecology.—This rare species was taken on the ocean reef.

SCARUS BREVIFILIS (Günther)

Pseudoscarus brevifilis GÜNTHER, Journ. Mus. Godeffroy, vol. 8, pt. 16, p. 327, pl. 161, 1909 (type locality, Tahiti, and Apamana, Gilbert Islands; type from Apamana examined in British Museum, Cat. No. 1873.4.3.106, standard length 215 mm.).

SPECIMENS STUDIED

Bikini Atoll: 13 stations, 28 specimens, 30 to 315 mm. in standard length.
Eniwetok Atoll: 1 station, 1 specimen, 175 mm.
Rongerik Atoll: 1 station, 2 specimens, 84 to 87 mm.
Rongelap Atoll: 3 stations, 18 specimens, 15 to 118 mm.
Arno Atoll: 1 lot, 5 specimens, 23 to 150 mm.

Remarks.—This species is characterized by having 5 to 7 median predorsal scales, 3 rows of scales on the cheek, with 1 to 3 scales in the ventral row; usually ii,13 pectoral fin rays; green teeth. In the young, the color pattern is mottled or almost barred, but in adults the background coloration is reddish brown, with a few scattered white spots posteriorly, and usually the first soft dorsal ray is a little elongate.

Ecology.—This species was abundant on the reef in the intertidal zone and in the deeper waters along the edges of reefs.

SCARUS GHOBBAN Forskål

Scarus ghobban FORSKÅL, Descriptions animalium . . ., p. 28, 1775 (type locality, Djedda, Red Sea).

SPECIMENS STUDIED

Marianas Islands: Saipan, August 14, 1952, School of Tropical and Preventive Medicine, 1 specimen, 131 mm.

Remarks.—This species is characterized by having 5 or 6 median predorsal scales, 3 rows of scales on the cheek, with 1 to 3 scales in ventral row; usually ii,13 pectoral rays; the background coloration very light orange or yellowish, marked with bright blue spots in center of scales, these blue-spotted scales arranged to form 5 bars that are 2 or 3 scales wide; base and outer margins of dorsal and anal fins blue edged; dorsal and ventral margins of caudal fin blue edged; edge of upper lip pale, then dorsally a blue blotch; lateral edge of lower lip blue, this color continues as a blue band to lower edge of eye; a blue band joins both eyes across interorbital space and other blue marks radiate from eye dorsoposteriorly; base of pectoral pinkish, not blue; dorsal edge of pectoral fin blue, the fin tinged with yellowish. These color notes are from a kodachrome taken by John Randall, University of Hawaii, and from a painting in the *Albatross* Philippine collection.

SCARUS CHLORODON Jenyns

Scarus chlorodon JENYNS, Zoology of the voyage of H. M. S. *Beagle*, pt. 4, Fish, p. 105, pl. 21, 1842 (type locality, Keeling Island, Indian Ocean; type examined in British Museum, skin, Cat. No. 1918.1.31.12, standard length 345 mm.).

SPECIMENS STUDIED

Bikini Atoll: 3 stations, 7 specimens, 185 to 390 mm. in standard length.
Eniwetok Atoll: 1 station, 1 specimen, 240 mm.
Rongelap Atoll: 1 station, 1 specimen, 275 mm.
Guam: 2 lots, 4 specimens, 295 to 330 mm.

Remarks.—This species is characterized by 6 or 7 median predorsal scales; 3 rows of scales on the cheek, with 1 to 3 scales in the ventral row, usually ii,13 pectoral fin rays; green teeth; dorsal and anal fins with distal fifth blue or green, basal four-fifths dark, these colors separated by a dark line. In green color phase it has characteristic light orange and dark green bars and bands on the head, upper lip pale with a dark bar dorsally, green dash on lower lip at its side and rear corner, otherwise pale, then bordered below by a broad green band that continues (sometimes broken) to lower border of eye, thence a short distance behind eye. Other characteristics are the elongate first soft dorsal ray of large adults, the yellowish to orange posterior margin of the caudal fin, and the green border on the dorsal and ventral edges of that fin.

SCARUS AERUGINOSUS Cuvier and Valenciennes

PLATE 108,E

Scarus aeruginosus CUVIER and VALENCIENNES, Histoire naturelle des poissons, vol. 14, p. 257, 1839 (type locality, Red Sea; type examined in Mus. Nat. Hist. Nat. Paris, from Pondicherry; Leschenault).

SPECIMENS STUDIED

Bikini Atoll: 3 stations, 12 specimens, 81 to 215 mm. in standard length.
Arno Atoll: 1 lot, 1 specimen, 74 mm.
Guam: 2 lots, 19 specimens, 38 to 205 mm.
Saipan: 2 lots, 2 specimens, 137 to 182 mm.

Ecology.—This parrot fish was rather scarce on the intertidal zone of the reefs. When taken it was found mostly on the ocean side and in areas of strong wave action.

Remarks.—This species is characterized by having 5 or 6 median predorsal scales; 3 rows of scales on the cheek, with 1 to 3 scales in the ventral row; usually ii,12 pectoral rays; whitish teeth; and a plain brownish or grayish background coloration with usually 3 pale streaks, one on each scale now of belly. There is no black spot at base of pectoral fin.

Subfamily SPARISOMATINAE

This subfamily is characterized by having the teeth incompletely coalesced into 4 plates, sometimes with pointed incisorlike teeth externally on the platelike structures; one row of scales with 2 to 4 scales on the cheek below eye; upper pharyngeal bones each with 3 rows of teeth; lower pharyngeal bone with dentigerous surface notably broader than long; number of teeth in middle rows of lower pharyngeals vary from 6 to 7, counting all rudiments; anterior nostril with a distinct cirrus, or dermal flap; lateral line interrupted below rear end of base of dorsal fin, than beginning again one row lower and continuing along midside of caudal peduncle; gill rakers 2 or 3+1+6 to 12; pectoral rays normally ii,11; dorsal spines flexible or pungent; median predorsal scales 4; abdominal vertebrae 9, caudal 16, always totaling 25.

Genus CALOTOMUS Gilbert

Calotomus Gilbert, Proc. U. S. Nat. Mus., vol. 13, p. 70, 1890 (type species, *C. xenodon* Gilbert).

CALOTOMUS SPINIDENS (Quoy and Gaimard)

Plates 108,C; 109,C

Scarus spinidens Quoy and Gaimard, Voyage autour du monde . . . sur . . . l'*Uranie* et la *Physicienne*, Zoologie, p. 289, 1824 (type locality, Vaigiou).

SPECIMENS STUDIED

Bikini Atoll: 10 stations, 13 specimens, 56 to 162 mm. in standard length.
Rongerik Atoll: 1 station, 1 specimen, 118 mm.
Eniwetok Atoll: 1 station, 1 specimen, 142 mm.
Rongelap Atoll: 5 stations, 10 specimens, 65 to 142 mm.
Arno Atoll: 1 lot, 4 specimens, 54 to 77 mm.
Guam: 1 lot, 1 specimen, 42 mm.
Saipan: 1 lot, 1 specimen, 159 mm.

Ecology.—This species is commonly taken on the reefs, but never abundantly. It feeds on coralline algae and corals; what appear to be mature eggs occur in specimens as short as 150 mm.

Remarks.—This species is characterized by having the background mottled gray and brown; fins grayish; radiating from eye are bands, two of which are more prominent, that extend from below eye to rear of mouth; snout more or less crossbarred; the color around the head somewhat variable; a dark blotch on membrane between dorsal spines I and II. At standard lengths of 148 to 158 mm., caudal fin with posterior margin broadly white edged (this white margin has a submarginal brownish line at standard lengths of 190 mm.), outer half of anal fin dusky, basal half pale, somewhat pale spotted; some scales on sides may have pale or white centers, but most of the scales are outlined with brown, rest of scale pale or scales may have pale mottlings; base of last 3 soft dorsal rays may have a black spot; anus blackish under scaly sheath; base of pectoral dark brown in specimens shorter than 130 mm., extremely dark brown or blackish in those shorter than 75 mm.

Genus LEPTOSCARUS Swainson

Leptoscarus Swainson, Natural history . . . Fishes, vol. 2, pp. 172, 226, 1839 (type species, *Scarus vaigiensis* Quoy and Gaimard).

LEPTOSCARUS VAIGIENSIS (Quoy and Gaimard)

Plates 108,F; 109,D,E

Scarus vaigiensis Quoy and Gaimard, Voyage autour du monde . . . sur . . . l'*Uraine* et la *Physicienne*, Zoologie, p. 288, 1824 (type locality, Vaigiou).

SPECIMEN STUDIED

Guam, Nov. 26, 1945, D. G. Frey, 1 male specimen, 205 mm.

Remarks.—This species, though abundant in the Philippine *Albatross* collections, was not seen or collected in the Northern Marshall Islands.

Family CIRRHITIDAE

By Leonard P. Schultz

Since publishing on this family in 1943 (U. S. Nat. Mus. Bull. 180, pp. 131–137), I have seen additional specimens, and these have caused me to alter considerably my opinion concerning the generic relationships within this family. The key presented here is based on the type species of each genus, with additional species admitted in a few cases. In the footnotes I have listed under each genus additional species examined. Certain species not examined by me are included on the basis of descriptions and figures.

Neocirrhites Castlenau (Proc. Zool. Acclim. Soc. Victoria, vol. 2, p. 101, 1873; type species, *N. armatus* Castlenau) appears to be related to *Hughichthys* Schultz but differs in having the dorsal fin "received in a scaly sheath of the back in which the spines lay alternately, forming two rows." I have not seen a specimen, and the description is too incomplete to permit me to allocate the genus.

The absence of fine scales on the gill membranes of small specimens, may indicate that these scales have not yet formed. Because of that possibility I have not placed as much value on that scale character as I did in 1943. Smith (Ann. Mag. Nat. Hist., ser. 12, vol. 4, pp. 625–652, figs. 1–3, 1951), in his revision of the fishes of this family occurring in the Western Indian Ocean, attaches too much value to the scaly gill membranes; his *Cirrhitus mossambicus*, for example, lacks such scales and it was based on 2 specimens 32 and 52 mm. in total length, about the same size as my types of *Cirrhitops hubbardi* (Schultz) which also lacked such scales. *Gymnocirrhites arcatus* lacks scales on the gill membranes at 48 mm. but at 100 mm. in standard length they are well developed.

Counts are recorded in table 106 for the genera and species of Cirrhitidae.

KEY TO THE GENERA OF THE CIRRHITIDAE

1*a*. Scales ctenoid, about 33 to 36 from upper edge of gill opening to base of caudal fin; dorsal rays X,15 to 19; anal III,7; jaws with a few canines; bases of median fins sealy.

  2*a*. Dorsal rays X,15; scales 33 or 34; upper jaw with a pair of canines, none on lower jaw . . . . **Isobuna** [59] Jordan

  2*b*. Dorsal rays X,19; scales 36; lower jaw with a pair of canines, none on upper jaw . . . . **Serranocirrhitus** [60] Watanabe

1*b*. Scales cycloid.

  3*a*. Head acutely pointed, anterior profile of head forming an angle of about 20 to 25 degrees; dorsal rays X,13 with 1 or 2 cirri on membrane behind tip of each spine; anal III,7; pectoral i or ii,7,v or vi; 3 rows of enlarged scales on cheek; premaxillaries with 2 rows of minute teeth anteriorly along inner edges of middorsal line; gill membranes over isthmus naked; no palatine teeth; upper lip with broad lobe opposite front of premaxillaries; no scales on mandible; no canine teeth. **Oxycirrhites** [61] Bleeker

  3*b*. Head not so acutely pointed, anterior profile of head forming an angle of 40 to 80 degrees; anal rays III,6; no teeth in a backwardly extending row inside of mouth along middorsal line of premaxillary.

    4*a*. Anterior profile of head forming an angle of 40 to 60 degrees; pectoral fin rays i,7,v or i,8,v; dorsal rays X,11 or 12, with a tuft of cirri on dermal membrane behind tip of each spine; scales on mandible and on gill membranes over isthmus; 4 to 7 rows of enlarged scales on cheek, usually bordered above and below by some minute ones. **Cirrhitoidea** Jenkins

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[59] *Isobuna* Jordan *in* Jordan and Herre, Proc. U. S. Nat. Mus., vol. 33, p. 158, 1907 (type species, *Paracirrhites japonicus* Steindachner and Döderlein); Smith, Ann. Mag. Nat. Hist., ser. 12, vol. 4, p. 626, 1951, *Paracirrhites* Steindachner and Döderlein (not of Bleeker), Denkschr. Acad. Wiss. Wein, vol. 48, p. 25, 1883 (type species, *P. japonicus* Steindachner and Döderlein, preoccupied by *Paracirrhites* Bleeker).

[60] *Serranocirrhitus* Watanabe, Bull. Biogeogr. Soc. Japan, vol. 14, No. 2, p. 17, fig. 2, 1949 (type species, *Serranocirrhitus latus* Watanabe; from off Itoman, Okinawa-Honto).

[61] *Oxycirrhites* Bleeker, Act. Soc. Sci. Indo-Néerl., vol. 2, p. 39, 1857 (type species, *O. typus* Bleeker).

Two other species referable to this genus are *O. morrisi* Fowler (Proc. Acad. Nat. Sci. Philadelphia, 1933, vol. 85, p. 359, Jan. 20, 1934, holotype USNM 93172, Palawan, P. I.) and *O. seftoni* Böhlke and Briggs (California Fish and Game, vol. 39, No. 3, pp. 375–380, figs. 1–3, 1953, off Palmilla Point, Baja California).

4*b*. Anterior profile of head forming an angle of 60 to 80 degrees; pectoral rays not i,7,v or i,8,v.

5*a*. Cheeks with fine scales, no rows of enlarged scales; vertical scale rows from upper edge of gill opening to base of caudal fin about 38 to 44.

6*a*. Pectoral rays i,6,vii; dorsal usually X,11 rarely X,12, with a tuft of dermal cirri on edge of membrane behind tip of each dorsal spine; palatine teeth feebly present or absent; mandibles naked; both jaws with short canine teeth-------- **Cirrhitus** Lacepède

6*b*. Pectoral rays, i,7,vi; dorsal X,13 with a simple cirrus on edge of membrane behind tip of each dorsal spine; palatine teeth present; mandibles with fine scales; canine teeth present only on lower jaw------------------------ **Hughichthys** [62] Schultz

5*b*. Cheeks with 3 to 7 rows of enlarged scales and sometimes additional tiny scales dorsally below eye, bordering the large scales.

7*a*. First 2 pectoral rays simple or unbranched; one or more cirri on edge of membrane behind tip of each dorsal spine; both jaws with a few short canines; cheek with 5 to 7 rows of enlarged scales and sometimes additional small ones bordering these large scales above or below; preopercle with fine, numerous dentae.

8*a*. Dorsal rays X,14; pectoral ii,6,vi---------- **Cirrhitops** [63] Smith

8*b*. Dorsal rays X,11 or 12.

9*a*. Pectoral rays ii,7,v; body with 5 broad dark bars and with a narrow dusky one between them.
Amblycirrhitus [64] Gill

9*b*. Pectoral rays ii,6,vii; body with a lengthwise pale band dorsally.
Gymnocirrhites Smith

7*b*. First pectoral ray simple, followed by branched rays.

10*a*. Dorsal rays X,16 or 17 probably a few cirri on membranous edge behind tips of each dorsal spine; scales about 45; palatine teeth absent; 3 rows of enlarged scales on cheek; dentae on preopercular edge coarse; pectoral rays i,6 or 7,vi------------------------- **Cyprinocirrhites** [65] Tanaka

10*b*. Dorsal rays X,11 or 12 rarely X,10 or X,13.

11*a*. Anterior profile of head forming an angle of about 60 to 65 degrees; lower lip deeply incised at tip of chin but the incision not completely separating lower lip; upper lip with a shallow incision each side of tip; mandible finely scaled posteriorly, naked anteriorly; cheek with 4 rows of enlarged scales, without additional small scales above or below the enlarged ones; preopercular edge with coarse dentae; pectoral rays i,7,vi; dorsal rays X,12 rarely X,13, the edge of membrane behind tip of each dorsal spine with a tuft of cirri or as few as 1 or 2 posteriorly.

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[62] *Hughichthys* Schultz, U. S. Nat. Mus. Bull. 180, p. 136, 1943 (type species, *Cirrhites melanotus* Günther).

[63] *Cirrhitops* Smith, Ann. Mag. Nat. Hist., ser. 12, vol. 4, p. 637, 1951 (type species, *Cirrhitus fasciatus* Bennett=*Cirrhitus cinctus* Günther 1860).

In addition to the species listed above I refer *Amblycirrhitus hubbardi* Schultz to this genus. I have compared it again with *C. fasciatus* and still believe it is distinct from that Hawaiian Island species. In this family most of the species in each genus have the same number of fin rays.

C. fasciatus and *C. hubbardi* have distinctive color differences but these might become the same at equal sizes.

[64] *Amblycirrhitus* Gill, Proc. Acad. Nat. Sci. Philadelphia, p. 105, 1862 (type species, *Cirrhitus fasciatus* Cuvier and Valenciennes 1829, pl. 47 (not of Bennett 1828), preoccupied, replaced by *Amblycirrhitus indicus* Fowler 1938).

[65] *Cyprinocirrhites* Tanaka, Dobutsugaku Zasshi (Zool. Mag.), vol. 29, no. 347, p. 265, 1917; Figures and descriptions of the fishes of Japan, No. 180, p. 507, pl. 137, fig. 384, 1918 (type species, *C. ui* Tanaka).

I refer to this genus *Cirrhitichthys polyactis* Bleeker and *Cyprinocirrhites stigma* Fowler. Smith indicates that *C. ui* is a synonym of *polyactis*.

Cirrhitichthys[66] Bleeker

11*b*. Anterior profile of head forming an angle of about 75 to 80 degrees; no incision at front of upper or of lower lips; pectoral rays i,6,vii.

12*a*. Cheek with 4 rows of enlarged scales, but no small scales bordering these above or below; dorsal rays X,12, with a tuft of cirri on membranous edge behind each dorsal spine; mandible with coarse scales; small canines in each jaw; palatines with teeth____**Cirrhitopsis**[67] Gill

12*b*. Cheek with 5 or 6 rows of enlarged scales, bordered above and below with numerous minute ones; dorsal rays usually X,11, with a single simple cirrus on membrane behind tip of each dorsal spine; scales about 46 to 50; mandible minutely scaled; canines in both jaws; palatines toothless or with very feeble minute teeth; preopercular edge finely denticulate.

Paracirrhites Bleeker

TABLE 106.—*Counts recorded for certain genera and species of* Cirrhitidae.

Genus and species	Fin rays																	
	Dorsal						Anal			Pectoral								
	X	10	11	12	13	14	III	6	7	i	ii	5	6	7	8	v	vi	vii
Cirrhitus:																		
nigropunctatus	5		5				6	6		7			7					7
albopunctatus	2		1	1			2	2		4			4					4
spilotoceps	10	1	9				10	10		20			20				1	19
alternatus	2		2				2	2		4			4					4
pinnulatus	6		6				5	5		5			5					5
Cirrhitoidea:																		
unimacula	1		1				1	1		1				1		1		
sexfasciata	1		1				1	1		1					1	1		
bimacula	7			7			7	7		13					13	13		
Cirrhitichthys:																		
analis	5			5			5	5		5				5			5	
aprinus	8			8			8	8		8				8			8	
corallicola	3			3			3	2	1	3				3			3	
Paracirrhites:																		
hemistictus	8	1	7				8	8		12			12					12
forsteri	3		3				3	3		10			9	1			1	9
Amblycirrhitus:																		
indicus	1			1			1	1			1			1		1		
Gymnocirrhites:																		
arcatus	12		12				12	12			20	20						20
Cirrhitops:																		
fasciatus	4					4	4	4			8		8				8	
hubbardi	3					3	3	3			6		6				6	

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[66] *Cirrhitichthys* Bleeker, Act. Soc. Sci. Indo-Néerl., vol. 2, p. 39, 1857 (type species, *Cirrhitus graphidopterus* Bleeker = *C. aprinus* Cuvier and Valenciennes).

Acanthocirrhitus Fowler, Proc. U. S. Nat. Mus., vol. 85, p. 50, 1938 (type species, *Cirrhitus oxycephalus* Bleeker).

In addition to the type species I refer to this genus *Cirrhitichthys corallicola* Tee-Van and *C. analis* Fowler. Probably *C. calliurus* Regan and *Cirrhitus murrayi* Regan belong here too; I have examined a paratype, USNM 157375 of the latter species.

[67] *Cirrhitopsis* Gill, Proc. Acad. Nat. Sci. Philadelphia, pp. 105, 109, 1862 (type species, *Cirrhitus aureus* Temminck and Schlegel).

Genus CIRRHITOIDEA Jenkins

Cirrhitoidea Jenkins, Bull. U. S. Fish Comm. vol. 22 (1902), p. 489, 1903 (type species, *C. bimacula* Jenkins; Honolulu).

Pseudocirrhites Mowbray *in* Breder, Bull. Bingham oceanogr. coll., vol. 1, No. 1, p. 48, 1927 (type species, *P. pinos* Mowbray; Isla de Pinos, Cuba).

KEY TO THE SPECIES OF CIRRHITOIDEA

1*a*. Dorsal rays X,12 (rarely X,13).
  2*a*. Two black ocellate spots, one on opercle, the others just below rear part of base of soft dorsal fin; vertical dark brown bars about 9, vertical scale rows from upper edge of gill opening to base of caudal fin 37 to 39. **C. bimacula** Jenkins
  2*b*. No black ocellate spots; vertical dark brown bars about 9 or 10 and more or less incomplete and broken in spots on caudal peduncle; vertical scale rows 40 ---------------------- **C. oxyrhynchos**[68] (Bleeker)
1*b*. Dorsal rays X,11.
  3*a*. Vertical scale rows about 42.
    4*a*. About 6 broad dark vertical bars with a distinct black spot, larger than eye, just below rear part of base of soft dorsal fin; a black bar across caudal peduncle ---------------------------- **C. pinos** Mowbray
    4*b*. Six dark brown broad vertical bars, separated by pale interspaces; no large black spots anywhere; all fins and head dark brownish. **C. sexfasciata**, new species
  3*b*. Vertical scale rows 50. A black spot at rear of base of soft dorsal. **C. unimacula**[69] Kamohara

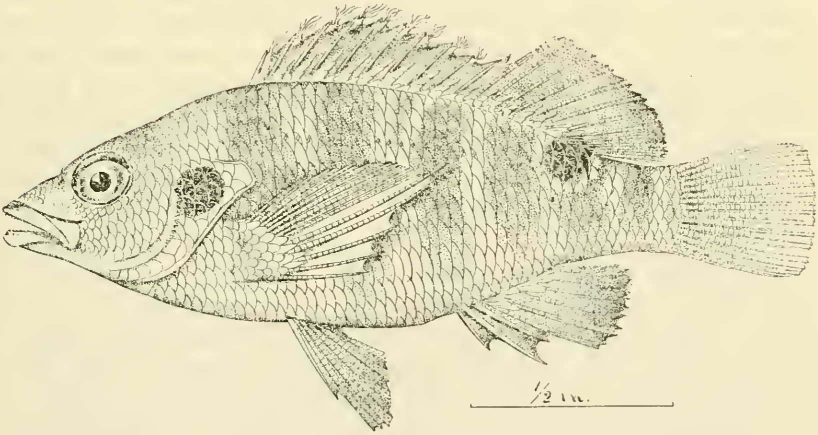

Figure 105.—*Cirrhitoidea bimacula* Jenkins, holotype, USNM 50702, after Jenkins.

CIRRHITOIDEA BIMACULA Jenkins

Figure 105

Cirrhitoidea bimacula Jenkins, Bull. U. S. Fish Comm., vol. 22 (1902), p. 489, fig. 36, 1903 (type locality, Honolulu).

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[68] *Cirrhitichthys oxyrhynchos* Bleeker, Nat. Tijdschr. Nederl.-Indië, vol. 15, p. 205, 1858 (type locality, Goram); Atlas ichthyologique . . . , vol. 7, p. 146, pl. 303, fig. 4, 1876–77.

[69] *Cirrhitoidea unimacula* Kamohara, Rep. USA Marine Biol. Station, Japan, vol. 4, No. 1, p. 29, fig. 19, 1957 (type locality, Somachi, Japan).

SPECIMENS STUDIED

Bikini Atoll: 2 stations, 3 specimens, 55 to 63 mm. in standard length.
Eniwetok Atoll: 1 station, 1 specimen, 50 mm.
Kwajalein Atoll: 1 station, 1 specimen, 67 mm.

Description.—Dorsal rays X,12; anal III,8; pectoral i,8,v; pelvic I,5; branched caudal fin rays 7+6; vertical scale rows from upper edge of gill opening to midbase of caudal fin 37 to 39, with 3½ or 4 scales from dorsal origin to lateral line, and 8 or 9 scales from anal origin to lateral line; 4 rows of enlarged scales on cheek; gill rakers 3 or 4+1+10 or 11.

Greatest depth 2.7 to 3.2; head 2.5 to 2.8; length of longest branched pectoral ray 4.0 to 4.7; longest lower simple pectoral ray 2.8 to 3.2; all in the standard length. Snout 3.2 to 3.6, eye 3.8 to 4.6, snout tip to rear of maxillary 2.9 to 3.0, greatest depth 1.1 to 1.3; least depth of caudal peduncle, 3.0; postorbital length of head 1.9 to 2.1; all in length of head. Least depth of caudal peduncle in its length 1.9. Bony interorbital 1.3 to 2.2 in eye.

Greatest depth opposite front part of dorsal base; profile of head pointed; gill membranes broadly joined across isthmus, free, covered with scales; maxillary concealed by preorbital anteriorly; lips thick, broad, lower lip at tip with a deep incision; upper lip deeply incised each side of its anterior tip; lower jaw equal to upper, or nearly so; when mouth is closed, the latter a little oblique; cheeks with 4 rows of enlarged scales, these bordered around orbit by some much smaller scales; mandibles with small scales; nostrils separated by a dermal isthmus, posterior margin of anterior one bearing a tuft of dermal cirri; behind tips of each dorsal spine occur a tuft of cirri; accessory pelvic scale very short; scales cycloid; interorbital and posterior part of preorbital scaled; vomerine teeth villiform in a V-shaped narrow band; probably no teeth on palatines or a very few minute ones at head of bone; a band of villiform teeth in upper jaw very broad anteriorly, becoming narrow posteriorly, bordered on the outside by a row of short conical teeth; lower teeth similar, except they become uniserial posteriorly; pelvic insertion behind pectoral base, about opposite base of fourth dorsal spine; basally all fins scaled; first lower simple pectoral ray longest; rear margin of caudal fin truncate; preopercular margin somewhat coarsely denticulate; interorbital space a little concave; lateral line complete.

Color in alcohol.—Background color pale or whitish, with about 10 brown bars separated by pale interspaces narrower than brown bars; these dark bars extending on scaled part of dorsal fin; opercle with a large dark brown ocellate spot; another dark brown ocellate spot in fourth-from-last dark bar, extending from lateral line on rear of base of soft dorsal fin; head with brown streaks; pectoral, pelvic, and caudal fins pale; eye with a black line posteroventrally, belly plain pale; breast and pectoral base with a few brown spots.

Ecology.—This species was taken on those parts of the reefs where coral growths were abundant and where wave action was strong.

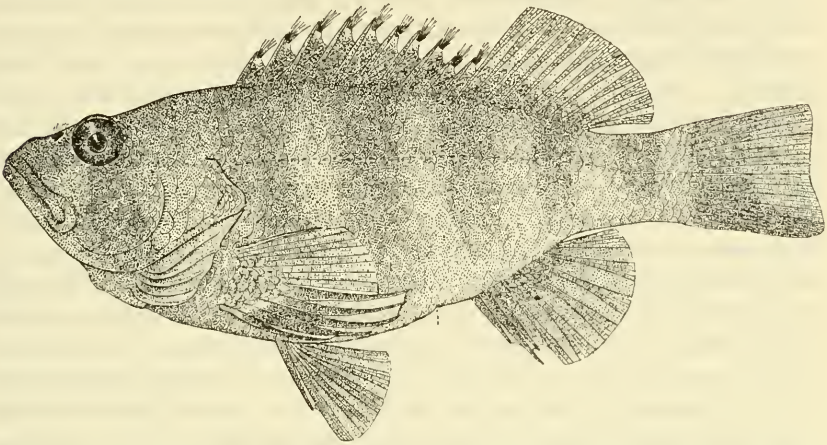

FIGURE 106.—*Cirrhitoidea sexfasciata*, new species, holotype, USNM 141980, from Bikini Atoll. Drawn by A. M. Awl.

CIRRHITOIDEA SEXFASCIATA, new species

FIGURE 106

Holotype.—USNM 141980 Bikini Atoll, Airy Island, ocean reef in surf, April 16, 1946, S–46–96, Schultz, standard length 77.5 mm.

Description.—Dorsal rays X,11; anal III,6; pectoral i,8,v—i,8,v; pelvics I,5; branched caudal rays 7+6; vertical scale rows from upper edge of gill opening to midbase of caudal fin 42; scales from dorsal origin to lateral line 4½ and 9 scales in a row from anal origin to lateral line; cheek with about 5 irregular rows of large scales and these posteriorly and dorsally with very small scales; gill rakers 4+1+10.

The following measurements, expressed in thousandths of the standard length, are recorded for the holotype: Length of head 361; snout 103; eye 76; postorbital length of head 194; greatest depth 374; least depth of caudal peduncle 124; length of caudal peduncle 219; snout tip to dorsal origin 348, to anal origin 715, to rear of maxillaries 155; bony interorbital space 41; longest simple pectoral ray 271; longest (fourth) dorsal spine 125; longest anal spine 142; length of caudal fin 230; length of pelvic fin 191; least suborbital width 46.

Greatest depth 2.7; head 2.7; length longest branched pectoral ray 4.7; longest lower simple pectoral ray 3.6; all in the standard length. Snout 3.1; eye 4.8; snout tip to rear of maxillary 2.3; greatest depth

1.0; least depth of caudal peduncle 2.8; postorbital length of head 1.9; all in length of head. Least depth of caudal peduncle in its length 1.5. Bony interorbital space 1.7 in eye.

Greatest depth opposite front of dorsal base; profile of head somewhat pointed; gill membranes broadly joined across isthmus, free, covered with minute scales; maxillary exposed posteriorly, concealed anteriorly; lips thick, broad, lower lip with a notch near tip of chin; lower jaw about equal to upper; mouth oblique; cheeks with about 5 irregular rows of large scales, these surrounded dorsoanteriorly and dorsoventrally with minute scales; mandibles with minute scales; nostrils separated by a dermal isthmus, posterior margin of anterior nostril with a tuft of cirri; behind tips of each dorsal spine a tuft of cirri; no accessory pelvic scale; scales cycloid; interorbital space and preorbital posteriorly, scaled; vomerine teeth villiform, in a broadly V-shape band; no teeth on palatines; a band of villiform teeth in upper jaws, broad anteriorly with an outer row of conical caninelike teeth; lower jaw with a patch of villiform teeth forward, bordered by a row of conical caninelike teeth continuing on side of jaw as a single row; pelvic insertion behind pectoral base, opposite base of fourth or fifth dorsal spine; basally, soft dorsal and anal, caudal, and pectoral fins scaled; first lower simple pectoral ray longest; rear margin of caudal fin truncate; preopercular margin coarsely denticulate; interorbital space a little concave.

Color in alcohol.—Six dark brown broad vertical bars, separated by paler light brown interspaces: first at origin of dorsal fin; second from between bases of fifth to eighth dorsal spines and extending ventrally to area in front of anus; third from front of soft dorsal fin and including last two dorsal spines, thence to front of anal fin; fourth from a little behind middle of soft dorsal base to behind anal base; fifth on caudal peduncle; and sixth across base of caudal fin; all fins and head dark brown.

Remarks.—This new species resembles in coloration *Cirrhitus fasciatus* Bennett and *Amblycirrhitus indicus* Fowler (=*Cirrhitus fasciatus* Cuvier and Valenciennes (not of Bennett)). From *C. fasciatus* Bennett, with X,14 dorsal rays and ii,6,vi pectoral rays, *Cirrhitoidea sexfasciata* differs by having X,11 dorsal and i,8,v pectoral rays.

A. indicus Fowler has X,12 dorsal, ii,7,v pectoral rays, whereas *C. sexfasciata* has X,11 and i,8,v, respectively. *A. indicus* has a few white spots dorsally, but *sexfasciata* has no white spots.

This new species may be separated from related species of Cirrhitidae by means of the accompanying keys.

It was named in reference to the 6 dark bars.

Genus CIRRHITUS Lacepède

Cirrhitus LACEPÈDE, Histoire naturelle des poissons, vol. 5, p. 2, 1803 (type species, *Cirrhitus maculatus* Lacepède=*Labrus pinnulatus* Bloch and Schneider=*Labrus marmoratus* Lacepède).

Schultz (Proc. U. S. Nat. Mus., vol. 100, pp. 547–552, pl. 13, 1950) described 3 new species in this genus. Smith (Ann. Mag. Nat. Hist. ser. 12, vol. 4, pp. 629–632, fig. 1, 1951) described another, *C. mossambicus*, on two specimens, 32 and 52 mm. in length. Study of the types of *nigropunctatus* in the National Museum, and of a specimen (MCZ 5761) from Mauritius, in comparison with J. L. B. Smith's figure of *C. mossambicus*, indicates that the latter is the young of *nigropunctatus*. The position of the dark bars and dark blotches on the back and ventrally, agree perfectly with the same ones on *nigropunctatus* and the dark streaks on the head correspond with those of *nigropunctatus*, which has been known previously only from adult specimens from Mauritius. The other small black spots are suggestive of *nigropunctatus* and not *pinnulatus*.

It is probable that Smith has placed too much emphasis on the scales on the gill membranes since in this genus they are partially embedded, and on the young they may be absent or may not appear without considerable drying of the membranes. It is unfortunate that Dr. Smith lacked comparative material from the tropical Pacific. Seldom does one have sufficient specimens to work out these problems. *Cirrhitus betaurus* Gill is a synonym of *C. rivulatus* (Valenciennes), see Tee-Van (Zoologica, New York Zool. Soc., vol. 25, pt. 1, pp. 54–58, 1940).

KEY TO THE SPECIES OF CIRRHITUS

1*a*. Vertical scale rows from upper edge of gill opening to base of caudal fin (counted just above lateral line) 46 to 49; dorsal rays X,11 or 12; anal III,6 or 7; gill rakers 5 or 6+1+9 to 11; scales on gill membranes over isthmus deeply embedded; young with 5 or 6 irregular vertical dark brown bars that with growth break up into round or oblong spots which have pale centers and are bordered by a dark brown line, outside of which is a white line; background color pale. (American Tropical Pacific.)________________________________**C. rivulatus** (Valenciennes)

1*b*. Vertical scale rows fewer than 44.

  2*a*. Head and body with numerous tiny white specks or spots arranged in rows on sides; background coloration brownish, with about 5 indistinct vertical dark bars; no black spots; gill membranes without scales; vertical scale rows about 38 or 39; plate 110, C. (Niuafoo Island, Tonga group.)________________________________**C. albopunctatus** Schultz

  2*b*. Color pattern not of tiny white spots; gill membranes over isthmus with tiny embedded scales on adults, these probably absent in young.

    3*a*. Head, and body dorsally and anteriorly, with numerous but scattered tiny dark brown or black specks; scales 41 or 42; plate 110,B. (Mauritius.)______________________**C. nigropunctatus** Schultz

3*b*. No tiny black specks.
  4*a*. Color pattern of snout and region below eye with numerous small roundish dark brown spots; plate 110,D. (Mauritius and Red Sea.)_______________________________**C. spilotoceps**[70] Schultz
  4*b*. Color pattern of snout and region below eye consisting of large dark blotches or streaks of more or less plain dark brown coloration.
    5*a*. Body overlaid with dark brown or blackish spots, in addition to a dark brownish background more or less in the form of irregular bars, or marbled pattern; interspaces white, but no dark-edged white spots____________**C. pinnulatus** (Bloch and Schneider)
    5*b*. No dark brown or black spots, in addition to the background of brownish coloration (more or less in the form of irregular bars or marbled pattern); often there are roundish white spots with dark edges largely or wholly occurring on the dark brown; interspaces whitish; plate 110,A. (Hawaiian Islands; Johnston Island.)_______________________________**C. alternatus**[71] Gill

CIRRHITUS PINNULATUS (Bloch and Schneider)

PLATE 110,E

Labrus pinnulatus BLOCH and SCHNEIDER, Systema ichthyologiae . . ., p. 264, 1801 (type locality, Tahiti).

Labrus marmoratus LACEPÈDE, Histoire naturelle des poissons, vol. 3, pp. 438, 493, pl. 5, fig. 3, 1802 (type locality, "Great Equatorial Ocean").

Cirrhitus maculatus LACEPÈDE, Histoire naturelle des poissons, vol. 5, pp. 2, 3, 1803 (no locality).

SPECIMEN STUDIED

Bikini Atoll: 9 stations, 30 specimens, 24 to 129 mm. in standard length.
Eniwetok Atoll: 2 stations, 5 specimens, 30 to 137 mm.
Rongerik Atoll: 1 station, 16 specimens, 25 to 113 mm.
Rongelap Atoll: 1 station, 4 specimens, 87 to 208 mm.
Kwajalein Atoll: 1 station, 3 specimens, 75 to 116 mm.
Guam: 1 lot, 3 specimens, 53 to 218 mm.

Description.—Dorsal rays, X,11; anal III,6; pectoral i,6,vii; pelvics I,5; branched caudal fin rays 7+6; vertical scale rows from upper edge of gill opening to base of caudal fin 39 or 40, with 4 or 5 scales from dorsal origin to lateral line and 9 from lateral line to anal origin; scale rows on cheek about 16 to 20; gill rakers on first gill arch 6 to 8+1+12.

Greatest depth 2.7 to 3.0; head 2.4 to 2.7; length of longest branched pectoral ray 4.1 to 4.6; longest lower simple pectoral ray 3.5 to 3.7; all in standard length. Snout 3.1 to 3.7; eye 4.0 to 4.5; tip of snout to rear of maxillary 2.4 to 2.6; greatest depth 1.1 to 1.2; least depth of caudal peduncle 2.7 to 3.3; postorbital length of head 1.9 to 2.0; all in length of head. Least depth of caudal peduncle in its length (base of last anal ray to midcaudal fin base) 1.8 to 1.9. Interorbital space (bony) 1.5 to 2.0 in eye.

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[70] In addition to the types in the U. S. National Museum, I have studied 7 specimens from Mauritius and 3 from the Red Sea, at the Museum of Comparative Zoology, Cambridge, Mass.

[71] *Cirrhitus alternatus* Gill, Proc. Acad. Nat. Sci. Philadelphia, p. 122, March 1862 (type locality, Honolulu; USNM 8043, holotype).

Greatest depth opposite front of spiny dorsal fin; head blunt, profile of snout steep; interorbital space concave; gill membranes broadly joined across isthmus, free, with numerous, fine, embedded scales; maxillary, except posterior end, concealed under preorbital edge; lips thick; lower jaw a little shorter than upper, mouth slightly oblique; cheek with fine embedded scales; nostrils separated by a wide dermal isthmus, anterior nostril with a tuft of cirri on posterior rim; posterior side of tips of dorsal spines with a tuft of cirri; no accessory pelvic scale; scales cycloid; vomer with a triangular patch of villiform teeth; palatines toothless; jaws with a band of villiform teeth, along outer margins of which are short, somewhat enlarged conical teeth; lateral line complete; pelvic insertion behind base of pectoral; bases of soft dorsal and of anal with a few scales, mostly anteriorly; first two lower simple pectoral rays longest; rear margin of caudal a little convex, nearly truncate; posterior margin of preopercle finely serrate.

Color in alcohol.—Background color pale or whitish, overlaid with numerous brown blotches and some smaller black spots; tip of chin next to thick lower lip with a dark brown spot, then a white space followed by a blackish or brownish bar; behind eye a distinct blackish spot; along base of dorsal fin usually 4 more or less distinct dark blotches, sometimes the dark blotches are arranged to form about 3 or 4 vertical bars, most evident in the smaller specimens; no small dark spots on snout; no small round white spots.

Color when alive.—Background color whitish, tinged with olive, dark spots brownish to blackish; the two dark streaks under eye yellowish brown; pectoral dull orange; no blue spots.

Ecology.—This species was taken on the reefs, where the surf was strong, among coral heads and in the surge channels.

Remarks.—A comparison of specimens of *Cirrhitus* from numerous parts of the tropical Indo-Pacific has revealed conclusively that several species are passing under the name of *pinnulatus*. We have studied this problem and are able to recognize the various species separated in the key, mostly by means of basic color patterns. The number of specimens, except for *pinnulatus*, are too few as yet to place much reliance on counts. The specimens of *pinnulatus* in the U. S. National Museum indicate that it may be confined to the tropical Pacific south of the Hawaiian Islands and Johnston Island. We believe Smith (Ann. Mag. Nat. Hist. ser. 12, vol. 4, pp. 629-632, 1951) has confused *spilotoceps* Schultz with *pinnulatus*. The latter, we think does not occur in the eastern Indian Ocean region, and Smith may never have seen a specimen of the true *pinnulatus*, which was very common in the Phoenix and Marshall Islands.

Genus GYMNOCIRRHITES Smith

Gymnocirrhites Smith, Ann. Mag. Nat. Hist., ser. 12, vol. 4, p. 638, 1951 (type species, *Cirrhitus arcatus* Cuvier and Valenciennes = *Cirrhitus amblycephalus* Bleeker).

GYMNOCIRRHITES ARCATUS (Cuvier and Valenciennes)

Plate 106,D

Cirrhitus arcatus Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 3, p. 74, 1829 (type locality, Mauritius; Tahiti).

SPECIMENS STUDIED

Bikini Atoll: 12 stations, 72 specimens, 30 to 85 mm. in standard length.
Eniwetok Atoll: 1 station, 2 specimens, 45 to 60 mm.
Rongelap Atoll: 7 stations, 45 specimens, 25 to 82 mm.
Kwajalein Atoll: 1 station, 7 specimens, 31 to 63 mm.
Likiep Atoll: 1 lot, Univ. Washington, 7 specimens, 46 to 65 mm.

Description.—Dorsal rays X,11; anal III,6; pectoral ii,5,vii; pelvics I,5; branched caudal fin rays 7+6; vertical scale rows from upper edge of gill opening to base of caudal fin 45 to 47 with 5 or 6 scales from dorsal origin to lateral line and 11 or 12 from anal origin to lateral line; 6 rows of scales on cheek; gill rakers 4 or 5+1+11 or 12.

Greatest depth 2.5 to 2.6; head 2.6 to 2.8; length of longest branched pectoral ray 4.5 to 5.6; length of longest lower simple pectoral ray 5.0 to 5.1; all in standard length. Snout 3.1 to 3.8; eye 3.5 to 5.0; tip of snout to rear of maxillary 2.1 to 2.2; greatest depth 0.8 to 1.0; least depth of caudal peduncle 2.5 to 2.9; postorbital length of head 1.8; all in length of head. Least depth of caudal peduncle in its length 1.5. Interorbital (bony) space 1.3 to 1.8 in eye.

Greatest depth at origin of dorsal fin; body compressed; interorbital space concave; gill membranes broadly joined across isthmus, free, naked; maxillary largely exposed, only anteriorly concealed by preorbital; lips very broad, moderately thick; jaws about equal; mouth oblique; scales on cheek large, in 6 rows; nostrils separated by a dermal isthmus, anterior nostril with a tuft of cirri on its posterior margin; posteriorly at tip of each dorsal spine a single dermal cirrus; on largest specimen, first soft dorsal ray is elongated, contained 1.3 in head, otherwise first soft dorsal rays are contained 1.5 to 2.0 in head; no accessory pelvic scale; scales cycloid; vomerine teeth villiform, in a triangular patch; no teeth on palatines; jaws with a villiform band of teeth, outer margins with a row of somewhat enlarged conical teeth and a short canine tooth on each side of symphysis in upper jaw, and about 3 short canine teeth on each side anteriorly on lower jaw; lateral line complete; pelvics inserted about under base of fourth dorsal spine, behind pectoral base; basally the rays of soft dorsal, anal, caudal, and pectoral fins with scales; usually the third lower simple pectoral ray longest; posterior margin of caudal fin a little rounded; preopercular edge finely denticulate.

Color in alcohol.—Background color brownish, interrupted above midaxis by a wide whitish band beginning just above lateral line below base of fifth or sixth dorsal spine and ending at base of caudal fin, dorsal part of caudal fin white, lower three-fourths dusky; all other fins dusky; behind eye a white dark edged V-shaped line, not quite completely broken posteriorly; 3 short black-edged white bars on lower margin of opercle and subopercle, sometimes broken into spots; midventral double-edged gill membranes over isthmus black-edged; inner ventral edges of lower jaws and opercular apparatus dusky edged.

There are two color patterns, the one described above and the following dark brown or blackish one: Background color dark brown with pale streaks following each scale row; no white streak dorsally on body; the pale blotches outlined in white, then black-edged occurring the same in both color phases.

Color when alive.—The white band is translucent pinkish orange; lower half of head and body pastel purplish orange, with brownish tinge; caudal fin pale olive-brown, with orange tinge on upper rays; eye brighter orange, with a red, V-shaped line behind eye, outer margin of red line black bordered; 3 short black-bordered red bars on lower part of opercular apparatus; basal two-thirds of dorsal fin orange.

Ecology.—This moderately common species was most abundant in those parts of the reefs where the wave action was strong and where coral growth was abundant.

Remarks.—*Cirrhites amblycephalus* Bleeker is a synonym of this species.

Genus PARACIRRHITES Bleeker

Paracirrhites Bleeker, Verh. Akad. Wet. Amsterdam, vol. 15, (2), 2, 5, p. 93, 1875 (type species, *Cirrhitus forsteri* Bloch).

KEY TO THE SPECIES OF PARACIRRHITES FROM THE MARSHALL ISLANDS

1*a*. Background color whitish below, light brown dorsally; a light brown streak on body along dorsal base, below which is a broad dark brown band, more intense posteriorly, blackish on upper side of caudal peduncle; caudal fin pale; head, base of pectoral, and isthmus with numerous scattered small dark brown or blackish spots; no spots on body behind pectoral and pelvic bases------------------ **P. forsteri** (Bloch and Schneider)

1*b*. Color pattern not as in 1*a*.

  2*a*. Background color whitish or pale, upper half of body darker than ventral half; along mid-axis of body from behind head a wide white band, becoming faint and disappearing on caudal peduncle; upper half of body with numerous roundish black spots and only a few indistinct ones below white band; caudal fin whitish; (female). **P. hemistictus** (Günther)

2*b*. Background coloration brownish with a white spot on side of body dorsally; blackish spots more prominent posteriorly (centers of scales darkish, thus the black spots are in lengthwise rows, more prominent ventrally); caudal, dorsal, anal, and pelvic fins dusky; pectoral dusky; no dark spots on head or ventrally in front of anal fin; (male= Bleeker's *Cirrhites polystictus*)----------- **P. hemistictus** (Günther)

PARACIRRHITES FORSTERI (Bloch and Schneider)

PLATE 111,B

Grammistes forsteri BLOCH and SCHNEIDER, Systema ichthyologiae . . . , p. 191, 1801 (type locality, St. Christine or Waitaho, Marquesas Islands).

Gerranus tankervillae BENNETT, Fishes found upon the coast of Ceylon, ed. 2, p. 27, pl. 27, 1834 (type locality, Ceylon).

SPECIMENS STUDIED

Rongelap Atoll, Rongelap Island, depth 10 to 60 feet, July 23, S-46-282, Brock, Herald, and Kohler, 1 specimen, 139 mm.

Description.—Dorsal rays X,11; anal III,6; pectoral i,6,vii; pelvic 1,5; branched caudal 7+6; vertical scale rows from upper edge of gill opening to midbase of caudal 48 or 49, with 6 scales from dorsal origin to lateral line and 11 or 11½ from anal origin to lateral line; 5 rows of large scales on cheek with smaller ones above and below; gill rakers 5+1+11 or 12.

Greatest depth 2.7; head 2.7; length of longest branched pectoral ray 6.5, of longest lower simple pectoral ray 5.1; all in standard length. Snout 3.1; eye 6.1; snout tip to rear of maxillary 2.4; greatest depth 1.0; least depth of caudal peduncle 2.6; postorbital length of head 1.8; all in length of head. Least depth of caudal peduncle in its length 1.6. Bony interorbital 0.9 in eye.

Greatest depth opposite front of dorsal base; profile of head blunt, gill membranes broadly joined across isthmus, free, with numerous fine scales on that part over isthmus; maxillary exposed posteriorly, concealed by preorbital anteriorly; lips thick, wide; lower jaw slightly shorter than upper; mouth a little oblique; cheek with 5 rows of large scales, and below eye some tiny ones, also small ones posteriorly on preopercle; nostrils separated by a dermal isthmus, rear margin of anterior nostril with a tuft of cirri; behind tip of each dorsal spine a single simple cirrus; no accessory pelvic scale; scales cycloid; vomer with a triangular patch of villiform teeth, probably no teeth on palatines; a band of villiform teeth in upper jaw, broadest forward, with an outer row of conical caninelike teeth, and on each side of symphysis an enlarged canine tooth; lower jaw with a narrow band of villiform teeth forward only, and an outer row of enlarged but short canine teeth; pelvic insertion behind pectoral base, about under base of fifth dorsal spine; bases of soft dorsal, anal, caudal, and pectoral fins with small scales; third lower simple pectoral ray longest; rear margin of caudal fin a little rounded; preopercular margin finely denticulate; interorbital space nearly flat, a trifle concave, and scaled.

Color in alcohol.—Background color white below, light brownish dorsally, a little darker forward and on head; a white or light brown streak below dorsal base, below which is a broad dark brown band, more intense posteriorly, blackish on upper side of caudal peduncle; dorsal edge of caudal peduncle white; caudal fin pale, with a blackish line on dorsal and ventral edges; head, base of pectoral breast, and isthmus with numerous scattered small dark brown or blackish spots; no spots on body behind pectoral and pelvic bases.

Ecology.—This species was taken only at depths of 10 to 60 feet; it was not seen over the shallower parts of the reefs.

Remarks.—Smith (Ann. Mag. Nat. Hist., ser. 12, vol. 4, p. 641, 1951) lists *Sparus pantherinus* Lacepède, as a synonym of *P. forsteri*= *Gerranus tankervillae* Bennett. Fowler (Fishes of Oceania, p. 239, 1929) lists *Perca taeniata* Cuvier also as a synonym of *P. forsteri.*

PARACIRRHITES HEMISTICTUS (Günther)

PLATE 111,C

Cirrhites hemistictus GÜNTHER, Journ. Mus. Godeffroy, vols. 2–3, pts. 5–6, p. 69, pl. 50, fig. B, 1874 (type locality, Kingsmill and Society Islands).

Cirrhites polystictus GÜNTHER, Journ. Mus. Godeffroy, vols. 2-3, pts. 5-6, p. 70, pl. 50, fig. A (type locality, Society Islands).

SPECIMENS STUDIED

Bikini Atoll: 3 stations, 5 specimens, 47 to 195 mm. in standard length.

Description.—Dorsal rays X,11; anal III,6; pectoral i,6,vii; pelvics I,5; branched caudal 7+6; vertical scale rows from upper edge of gill opening to midbase of caudal fin 47 to 49; scales from dorsal origin to lateral line 5½, and from anal origin to lateral line 11; scale rows on cheek 6; gill rakers on first arch 5+1+10 or 11.

Greatest depth 2.9 to 3.0; head 2.6 to 2.8; length of longest branched pectoral ray 5.0 to 6.4; of longest lower simple pectoral ray 4.2 to 5.5; all in standard length. Snout 2.8 to 3.3; eye 4.4 to 6.2; snout tip to rear of maxillary 2.4 to 2.5; greatest depth 1.1 to 1.2; least depth of caudal peduncle 2.5 to 2.8; postorbital length of head 1.8 to 1.9; all in length of head. Least depth of caudal peduncle in its length 1.5 to 1.8. Interorbital space (bony) 0.8 to 2.0 in eye.

Greatest depth opposite middle of base of spiny dorsal fin; profile of head blunt, gill membranes broadly joined across isthmus, free, naked; posteriorly the maxillary is exposed, anteriorly it is concealed under preorbital; lips thick, broad; lower jaw slightly shorter than upper, mouth a little oblique; cheek with 6 rows of large scales; nostrils separated by a dermal isthmus, rear margin of anterior nostril with a tuft of cirri; a single simple cirrus behind tip of each dorsal spine;

no accessory pelvic scale; scales cycloid; vomer with a triangular patch of teeth, a few tiny teeth on front of palatines in largest specimen, absent in smallest; a band of villiform teeth in upper jaw, broadest forward, with an outer row of conical caninelike teeth, and each side of symphysis an enlarged canine tooth; lower jaw with a narrow band of villiform teeth forward only, an outer row of enlarged but short canine teeth; pelvic insertion behind pectoral base, opposite base of fourth or fifth dorsal spine; bases of soft dorsal, anal, caudal, and pectoral fins with scales; third lower simple pectoral ray longest; rear margin of caudal fin truncate or slightly rounded; preopercular margin finely denticulate, becoming rough in largest specimen; interorbital space flattish in young, a little concave in adults, and scaled.

Color in alcohol.—Background color whitish or pale, upper half of body a little darker than lower half; along midaxis of body from behind head a wide white band, becoming faint and disappearing on caudal peduncle; upper half of body with numerous roundish black spots and below white band only a few indistinct ones; caudal white, edged above and below by a black line; midventral part of gill membranes blackish; dark spots lacking on head; lower half of head white, upper park dusky.

Color when alive.—Upper half of body and of head light brownish, more dusky forward; spots black; lower half of body with about 5 orange-yellow lengthwise streaks; all fins orange-yellow; snout and pale streak below eye pinkish; lower lip pink; pale lateral band pink.

Ecology.—This species occured among coral heads where there was considerable wave action.

Remarks.—Marshall (Bull. Raffles Mus., Singapore, No. 22, pp. 183–4, 1950) suggested that *P. hemistictus* and *P. polystictus* are the same species. I have been able to determine the sex of 5 of our specimens; of these, the 3 with the color pattern of *hemistictus* are females, and the 2 with the color pattern of *polystictus*, as illustrated here (plate 111,C), are males. I therefore conclude that *polystictus* is the male of *hemistictus*.

Family MUGILOIDIDAE

By Leonard P. Schultz

I have spent considerable time investigating what genera of fishes should be referred to this family and have concluded that it is not possible to determine with certainty until further osteological investigations are made. The character by which the Mugiloididae are distinguished from the Branchiostegidae (= Latilidae) is the position of the pelvic fins. In the Mugiloididae the pelvics are supposed to be in front of the pectoral base, whereas in the Branchiostegidae the pelvics are under or a little in front of pectoral base. Actually, in *Mugiloides chilensis* (Molina) the pelvics are nearly under the pectoral fin base. In *Parapercis* they are more anteriorly placed. However, there is so much variability in the position of the pelvic fins among the species usually referred to these families that other characters must be employed.

Macrias Gill and Townsend (Science, new ser., vol. 14, p. 937, 1901) has been referred to the Mugiloididae by Jordan (Stanford Univ. Publ. Biol. Sci., vol. 3, No. 2, p. 229, 1923) but the original description does not indicate that *Macrias* belongs in this group. Unfortunately, the type has not been saved.

Townsend (Bull. New York Zool. Soc., vol. 39, No. 1, p. 29, fig. 1936) published a photograph[72] of *M. amissus*. From it, I conclude that *Macrias* belongs to the family Notothenidae because the illustration shows (1) the pelvics are inserted in advance of pectorals; (2) two dorsal fins, the first spinous; and (3) two lateral lines, a dorsal one, then posteriorly a lateral line along midside. The other characters are likewise those of notothenids.

Among those genera of which I have seen specimens, I would refer the following, in addition to *Parapercis*, to the Mugiloididae; *Mugiloides* Lacepède (= *Myxonum* Rafinesque); *Pinguipes* Cuvier and Valenciennes; *Prolatilus* Gill; *Pseudoperces* Ribeiro; *Parapercichthys* Whitley and Phillips; and *Porteridia* Fowler. There may be other genera in the family Branchiostegidae (= Latilidae) that belongs here too. These families resemble the Notothenidae but may be distinguished by having 2 pairs of nasal openings, whereas the Notothenidae have only a single pair.

The following characters appear to be shared by the genera listed above:

Branched caudal fin rays 8+7; two pairs of nostrils, anterior tubular; one opercular spine; gill membranes attached to the isthmus far forward, with a broad to narrow fold across isthmus; pelvics I,5, with third or fourth branched rays longest; fourth gill arch with a restricted opening behind it; lateral line complete, mostly following dorsal profile on side of body, but on midside posteriorly; pelvic insertion under to in front of pectoral fin base and in front of the dorsal fin origin; dorsal fin continuous with III to VIII spines followed by soft rays; anal origin under front part of base of soft dorsal; head mostly scaled, except preorbital and snout; no scales on dorsal and anal fins; scales basally on pectoral and caudal fins; vomer and palatines with or without teeth.

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[72] Unfortunately the original photograph published by Dr. Townsend cannot be located, according to a letter (Jan. 7, 1957) from Dr. William Bridges, Curator of Publications, New York Zoological Society.

Genus PARAPERCIS Bleeker

Percis Bloch and Schneider, Systema ichthyologiae . . . , p. 179, pl. 38, 1801 (type species, *Percis maculata* Bloch and Schneider; preoccupied).

Parapercis Bleeker, Nederl. Tijdschr. Dierk., vol. 1, p. 236, 1863 (type species, *Percis cylindrica* Cuvier and Valenciennes = *Sciaena cylindrica* Bloch).

Parapercis (non Bleeker) Steindachner, Sitzber. Akad. Wiss. Wien, vol. 88, No. 1, p. 1071, 1884 (type species, *Parapercis ramsayi* Steindachner).

Neopercis Steindachner, Denkschr. Akad. Wiss. Wien, vol. 49, No. 1, p. 212, pl. 6, figs. 2, 2a, 1885 (type species, *Neopercis multifasciatus* Steindachner; on plate, *Neopercis* proposed to replace *Parapercis* Steindachner).

Chilias Ogilby, Proc. Roy. Soc. Queensland, vol. 23, p. 40, 1910 (type species, *Percis stricticeps* De Vis).

Osurus Jordan and Evermann, Bull. U. S. Fish Comm., vol. 22 (1902), p. 206, 1903 (type species, *Parapercis schauinslandi* Steindachner).

Although several species of sand perches have been described from the central and western tropical Pacific ocean only three species were collected in the Northern Marshall Islands. These are found in the Philippines and were reviewed by Martin and Montalban (Philippine Journ. Sci., vol. 56, No. 2, pp. 215–227, pls. 1–3, 1935). In that review the plates numbered 2 and 3 are interchanged.

The following key identifies the species of *Parapercis* taken in the Northern Marshall Islands:

1*a*. Dorsal spines IV; pectoral rays usually i,16; scale rows above lateral line 58 to 60, in a vertical row from anal origin to dorsal fin base 12 to 14+1+7 or 8; no dark bar across breast
  2*a*. Side of body below the lateral line with 9 distinct small roundish black spots, an additional one at lower edge of pectoral fin base; caudal fin with several small dark spots but never with a central dark blotch; middle ray of caudal fin white; gill rakers 4 or 5+1+11 or 12. **P. clathrata** Ogilby
  2*b*. Sides of body with 9 brownish bars and a large dark brown blotch below pectoral base; side of head with 2 dark brown blotches below eye; lips with two brown blotches; caudal fin with a central blackish blotch, mostly in lower half of fin rays, followed posteriorly with a white blotch. Gill rakers 4 or 5+1+9_______**P. cephalopunctatus** (Seale)
1*b*. Dorsal spines V; pectoral rays usually i,14; scales 54 or 55; scales in a vertical row from anal origin to dorsal fin base 14 or 15+1+4; gill rakers in one count 4+0+6; a dark bar across breast; 9 or 10 dark bars on sides meeting their fellow along midventral line; tip of snout with two white streaks bordered by brown lines; tip of chin with 3 dark spots on lower lip____**P. cylindrica** (Bloch)

PARAPERCIS CLATHRATA Ogilby

Plate 112,A

Parapercis clathrata Ogilby, Proc. Royal Soc. Queensland, vol. 23, p. 41, 1910 (substitute name for *Percis tetracanthus* Lacepède 1803; for synonymy see Martin and Montalban, Philippine Journ. Sci., vol. 56, No. 2, p. 222, and pl. 2 (=3), fig. 1, as printed, 1935).

SPECIMENS STUDIED

Bikini Atoll: 4 stations, 5 specimens, 42 to 115 mm. in standard length.
Rongelap Atoll: 7 stations, 19 specimens, 39 to 126 mm.
Rongerik Atoll: Bock Island, 1 specimen, 85 mm.
Kwajalein Atoll: 1 lot, 4 specimens, 87 to 108 mm.

Description.—Dorsal rays IV,20 or 21; anal, I,17; pectoral i,16; pelvics I,5; branched caudal fin rays usually 8+7; scale rows above lateral line from upper edge of gill opening to base of caudal fin 58 to 60, scales from anal origin to dorsal fin base 12 to 14+1+6 to 8; gill rakers on first gill arch 4 to 6+0 to 1+10 to 12.

Greatest depth 6⅓ to 7¼; head length to fleshy rear tip of operculum 3 to 3⅓; length of base of anal fin 2½; and length of base of dorsal fins 1¾ to 1⅘; all in standard length. Snout 2.9 to 3.2; eye diameter 3.9 to 4.5; fleshy interorbital 10 to 11; maxillaries from tip of snout to its rear edge 2.6 to 2.7; postorbital length of head 2.0 to 2.1; longest dorsal spine 4.7 to 4.9; longest pectoral ray 1.5; longest pelvic ray 1.3 to 1.4; least depth of caudal peduncle 3.5 to 3.7; all in length of head. Least depth of caudal peduncle 1.0 to 1.1 in its length. Interorbital (fleshy) space 2.3 to 3 in eye diameter.

Body elongate, head somewhat depressed; gill membranes broadly united across isthmus, with a wide free fold; scales ctenoid on body, scales on head confined to operculum and a few scattered ones on the cheeks; dorsal and ventral surfaces of head naked; breast scaled, caudal fin scaled three fourths of its length, pectoral fin rays basally covered with scales; no scales on rays of dorsal anal, and pelvic fins; gill rakers short; thick; a slit behind fourth gill arch; pseudobranchiae present; vomer with villiform patch of teeth, palatines toothless; upper and lower jaws with a patch of villiform teeth anteriorly, bordered on the outside by canine teeth, becoming a single row laterally; lower jaw projects notably in front of tip of snout; much of the maxillary slips under preorbital; the two nasal openings separated by a wide dermal isthmus, premaxillaries protractile; pelvics inserted a little in front of base of pectorals, third dorsal spine longest; fourth pelvic soft ray longest.

Color in alcohol.—Background color whitish, with a series of 9 prominent blackish spots along sides below lateral line, and corresponding with these spots are scarcely discernible vertical bars that unite with the adjoining ones above lateral line, thence continue to the base of the dorsal fin, thus forming a W-shaped set of markings on upper parts of body; the dorsal part of the sides is abruptly darker than below and the pale portion is set off by a narrow streak of brown dots, mostly above lateral line; dorsal surface of head and back with brown dots; below eye is a brown blotch, and usually behind this a silvery blotch; a black spot below base of pectoral in line with series of black lateral spots; caudal fin with brown spots; the most outstanding color mark is an ocellated brown to blackish spot above operculum near rear of posttemporal fork.

Ecology.—This species lives in the areas of loose sand, sometimes appearing to come from holes or from under coral slabs.

PARAPERCIS CEPHALOPUNCTATUS (Seale)

Plate 112,C–E

Percis cephalopunctatus Seale, Occ. Pap. Bishop Mus., vol. 1, No. 3, p. 124, 1901 (type locality, Guam).

Parapercis montillai Martin and Montalban, Philippine Journ. Sci., vol. 56, No. 2, p. 224, pl. 3 (2), fig. 2, 1935 (type locality, Philippines).

Parapercis tetracanthus Jordan and Seale, Bull. U. S. Bur. Fish., vol. 25, p. 414, 1906 (Samoa).—Schultz, U. S. Nat. Mus. Bull. 180, p. 269, 1943, (Phoenix and Samoan Islands).

SPECIMENS STUDIED

Bikini Atoll; 23 stations, 121 specimens, 46 to 124 mm. in standard length.
Eniwetok Atoll: 4 stations, 13 specimens, 88 to 116 mm.
Rongelap Atoll: 8 stations, 119 specimens, 24 to 125 mm.
Rongerik Atoll: 5 stations, 29 specimens, 25 to 117 mm.
Kwajalein Atoll: 1 station, 7 specimens, 56 to 103 mm.

Description.—Dorsal rays IV,21; anal I,17; pectoral i,16; pelvics I,5; branched caudal fin rays 8+7; scale rows from upper edge of gill opening to base of caudal fin 59 or 60; scales in a row from anal origin to dorsal fin base 13 or 14+1+7; gill rakers on first arch 4 or 5+1+9.

Greatest depth 6.4 to 6.7; head length to fleshy tip of operculum 3.2 to 3.5; length of base of anal fin 2.5; length of base of dorsal fin 1.8 to 1.9; all in standard length. Snout 3.0 to 3.4; eye diameter 4.0 to 5.0; fleshy interorbital space 11.5 to 13; tip of snout to rear edge of maxillary 2.6 to 2.8; postorbital length of head 2.0 to 2.1; longest dorsal spine 5.1 to 5.5; longest pectoral ray 1.6 to 1.7; longest pelvic ray 1.3 to 1.5; least depth of caudal peduncle 3.8 to 4.3; all in the length of the head. Least depth of caudal peduncle 1.1 in its length. Interorbital (fleshy) space 2.5 to 3.5 in eye diameter.

Body elongate; head somewhat depressed; gill membranes broadly united across isthmus, with a wide free fold; scales ctenoid on body, head naked except for a patch on operculum and several scattered ones on the cheek; breast scaled; caudal fin scaled two-thirds to three-fourths distance to tip of rays; bases of pectoral fin rays with scales, other fins naked; gill rakers short, thick; a slit behind fourth gill arch; pseudobranchiae present; vomer with a patch of villiform teeth; palatines toothless; both jaws with a wide band of villiform teeth anteriorly, bordered on the outside with several conical caninelike teeth, laterally these teeth form a narrow band, then posteriorly a single row; lower jaw projecting a little in front of tip of snout; part of the maxillary slips under the preorbital; the two nasal openings separated by a wide dermal isthmus; premaxillaries protractile; pelvics inserted a little in front of pectoral fin bases, third dorsal spine longest; fourth pelvic soft ray longest.

Color in alcohol.—Background color whitish, the sides with about 9 vertical bars narrower than the pale interspaces, bars fading ventrally so that they do not always meet their fellow along the midventral line; base of pectoral brownish to dark brownish, forming an additional bar; no dark band across breast; dorsally the dark bars more or less join with their neighbor to form a W-shaped pattern along the upper sides and back; a brownish line extends lengthwise below lateral line; every second or third dorsal ray at base with a dark spot, these occurring where the dorsal dark bars meet along the middorsal line; dorsal surface of head with dark spots, usually a pair near middorsal line of head behind interorbital space most prominent followed by another pair halfway to dorsal origin; cheek with a prominent dark blotch, another on operculum, these two separated by a bright silvery blotch; snout and front of lower jaw brownish; a large brown blotch laterally on upper and lower lips; caudal fin variously dark spotted and blotched basally, sometimes the basal blotch is solid blackish followed in the middle caudal fin rays with a white blotch; paired fins white; anal white; dorsal fin with a few dark dots.

Color when alive.—(From a kodachrome): Upper part of body and head pale brownish tinged with orange, undersides white; anal fin pale yellowish orange, pelvics pale orange; two pale yellowish orange bars cross on underside of mouth largely faded in the alcoholic specimens.

A color drawing of this species in the Philippine *Albatross* collection has the tips of the median fins blue, pectoral pale orange, pelvics bright orange, bars on sides of body reddish brown; the two dark spots below orbits brown bordered by yellow-orange; pale areas dorsally light bluish.

Ecology.—This abundant species in the Northern Marshall Islands occurred in the sandy areas. It lives under coral slabs, or partly concealed in the sand.

Remarks.—During this study the Marshall Island material was compared with specimens from other localities, with the exception of the Philippines. It agreed reasonably well with the description by Seale and by Martin and Montalban. All the specimens reported upon by Schultz (U. S. Nat. Mus. Bull. 180, p. 269, 1943) as *Parapercis tetracanthus* are this species as well as those from the Samoan Islands reported upon by Jordan and Seale. We have specimens from the Fiji Islands and Okinawa. This indicates a very extensive range for *P. cephalopunctatus*.

PARAPERCIS CYLINDRICA (Bloch)

Plate 112,B

Sciaena cylindrica Bloch, Naturgeschichte der auslandischen Fische, pt. 6, p. 42, pl. 299, fig. 1, 1792 (reference copied).

SPECIMENS STUDIED

Bikini Atoll: Urochi Island, ocean reef, July 13, S–46–251, Herald, 1 specimen, 97 mm.

Rongelap Atoll: Kabelle Island, lagoon reef, June 20, S–46–231, Schultz and Herald, 1 specimen, 96 mm.

Description.—Dorsal rays V,21; anal I,17; pectorals i,14; pelvics I,5; branched caudal fin rays 8+7; scale rows above lateral line from upper edge of gill opening to caudal fin base 54 or 55; scales in a row from anal origin to dorsal fin base 14 or 15+1+4; gill rakers (one count) 4+0+6.

Greatest depth 4.3 to 5.0; head length to fleshy tip of operculum 3.5 to 3.7; length of base of anal fin 2.3; of base of dorsal fins 1.6 to 1.7; all in standard length. Snout 2.3 to 2.4; eye 4.1; fleshy interorbital 6.7 to 7.5; maxillary from tip of snout to its rear edge 2.2 to 2.6; postorbital length of head 2.5 to 2.6; longest dorsal spine 2.5 to 2.6; longest pectoral ray 1.3 to 1.4; longest pelvic ray 0.8 to 0.9; least depth of caudal peduncle 2.9 to 3.0; all in length of head. Least depth of caudal peduncle 1.0 in its length. Interorbital (fleshy) space 1.6 to 1.9 in eye diameter.

Body elongate, more robust than in *clathrata* and *cephalopunctatus;* dorsal part of head little depressed; gill membranes forming a broad free fold across isthmus; scales ctenoid on body, cheeks and operculum fully scaled, dorsal and ventral surfaces of head naked; breast scaled; caudal fin scaled from half to three fourths distance to tip of rays; base of pectoral rays scaled; other fins naked; gill rakers short, thick; slit behind fourth gill arch; pseudobranchiae present; vomer with a narrow band of villiform teeth; upper and lower jaw with a broad patch of villiform teeth anteriorly, then externally enlarged conical teeth, teeth at sides of jaws in a narrow band bordered externally with small conical teeth; upper and lower jaws of nearly equal length; maxillary partly slips under the preorbital; nasal openings on each side separated by a wide dermal isthmus; premaxillaries protractile; pelvics inserted under bases of pectoral; fourth dorsal spine longest.

Color in alcohol.—Background color whitish, with 9 or 10 dark brown bars on lower sides of body, then forming a reticulated pattern above lateral line; along base of dorsal fin occur black spots in pairs at base of fin ray then following fin ray without a spot; the dark bars meet their fellow along midventral line of body; a dark brown blotch at base of each pelvic fin; V-shaped brown band across breast; white streak bordered with a brown line extending in front of eye to snout; upper lip with two white streaks bordered by brown lines; cheek brownish, with a pale streak below eye; lower lip with 3 brown blotches; median fins brown spotted; spinous dorsal with a blackish blotch.

Color when alive.—The following notes are based on a color drawing from the Philippine *Albatross* collections. Bars on sides of body bluish brown; back tinged with greenish brown; spot on spiny dorsal dark blue bordered with a white edge; pale streaks in front of eye and on upper lip orange; pelvics and ventral sides of body tinged with pale blue; distal edge of soft dorsal pale greenish, below which are reddish brown spots.

Ecology.—This species inhabits sandy areas.

Family TRICHONOTIDAE

By Leonard P. Schultz

This is a "catch-all" family to which several genera have been referred. Schultz (Journ. Washington Acad. Sci., vol. 31, pp. 269–272, 1941; U. S. Nat. Mus. Bull. 180, pp. 260–267, 1943) referred several genera of sand-inhabiting fishes to the family Trichonotidae merely as a practical convenience in identifying this variable group of genera. In the key presented by Schultz in 1943, section 2b should have followed section 6b, and in 1941 2b should follow 3b. These were transposed through a typographical error. The genus *Kraemeria* was recently studied by Gosline (Pacific Sci., vol. 9, pp. 158–170, figs. 1–7, 1955) and shown to be a gobioid fish. *Gobitrichinotus radiocularis* Fowler (U. S. Nat. Mus. Bull. 100, vol. 14, pt. 2, pp. 85–87, fig. 22, 1943), from the Philippines, with united pelvic fins, appears related to *Kraemeria.*

The problem of how many families to recognize in this relationship cannot be determined at present, so little is known about the osteology of the diverse genera referred to the trichonotid-like fishes; however, it can be said, at least, that a separate family for each genus should not be recognized.

The following key was intended as a practical aid for identifying the peculiar genera that are more or less related to the trichonotid-like fishes. The members of this relationship are distributed throughout tropical seas and live mostly in sandy habitats, or at least are bottom dwellers.

KEY TO THE GENERA RELATED TO THE TRICHONOTIDAE AND PERCOPHIDIDAE

1*a*. Pelvic fins absent.

2*a*. Snout fleshy, projecting beyond tip of lower jaw; lateral line curved down behind pectoral fin and thence running a ventral course, one scale row removed from anal fin base; dorsal rays 33 to 38; anal 29 to 31, its origin under base of seventh or eighth dorsal ray; pectoral rays 12, scale rows from upper edge of gill opening to base of caudal fin 57 to 61, with 5 above lateral line and 1 below it. (Delagoa Bay, South Africa.)---------------------------------- **Apocreedia** [73] Beaufort

2*b*. Snout not fleshy, jaws about equal; lateral line not described; dorsal rays VI,24; anal "vi,21"; pectoral 18; scale rows from upper edge of gill opening to base of caudal fin about 72; anal origin under base of third soft dorsal ray. (China Sea.)----- **Oxuderces** [74] Eydoux and Souleyet

1*b*. Pelvic fins present; pelvic rays I,4 or I,5.

3*a*. Dorsal fin single, first 2 or 3 rays, if detached, are long and filamentous; opercle lacks a spine.

4*a*. Origin of anal fin in front of dorsal origin and notably closer to tip of snout than to base of caudal fin; pelvic rays I,5.

5*a*. Lateral line along midside all the way to base of caudal fin; dorsal fin origin closer to tip of snout than to caudal fin base, 1.4 head lengths behind snout tip, and over base of fourth or fifth anal ray; anal origin 1.1 to 1.2 head lengths behind tip of snout; lower jaw projects a little beyond upper jaw; dorsal rays 32; anal 36 or 37; pectoral 16; scales 42. (Victoria, Australia.)
Lesueurina [75] Fowler

5*b*. Lateral line below midside, at least posteriorly.

6*a*. Dorsal fin origin equidistant between caudal fin base and rear of head, or about 2.2 head lengths behind tip of snout; pectoral fin rays undifferentiated; lateral line along anal fin base for its entire length; jaws about equal, lower jaw probably slightly longer than upper jaw; dorsal rays about 12; anal about 26; pectoral 12; scales about 40, with 4 above lateral line and only 1 scale below. (Australia.)----------------- **Creedia** [76] Ogilby

6*b*. Dorsal fin origin closer to rear of head than to caudal fin base.

7*a*. Upper rays of pectoral fin notably shorter than lower rays, the latter thickened and expanded; dorsal fin origin over base of about eight or ninth anal ray; lateral line next to anal fin base in its posterior half only; jaws about equal; dorsal rays 19; anal 29; pectoral 8+9=17; scales 37. (Australia.)
Schizochirus [77] Waite

7*b*. Pectoral rays undifferentiated; not as in *Schizochirus*.

8*a*. Scales about 100 to 110, very small; dorsal fin origin closer to snout tip than to caudal fin base; dorsal fin origin 1.5 head lengths behind rear of head; lateral line parallel to anal fin base and about 3 or 4 scales removed from it; jaws equal, snout not fleshy; dorsal rays 35; anal 42; pectoral 15. (New Zealand.)------------------------**Tewara**[78] Griffin

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[73] *Apocreedia* Beaufort, Trans. Roy. Soc. South Africa, vol. 31, pt. 5, p. 476, fig. 1, 1948 (type species, *A. vanderhorsti* Beaufort; USNM 144489, 3 paratypes).

[74] *Oxuderces* Eydoux and Souleyet, in Voyage autour du monde exécuté pendant . . . 1836 et 1837 sur . . la *Bonite*, Zoologiè, vol. 1, pt. 2, p. 181, pl. 8, fig. 3, 1842 (type species, *O dentatus* Eydoux and Souleyet).

I have seen no specimens. The inclusion of this genus as related to the Trichonotidae is open to doubt. The type or other specimens must be studied to determine relationships.

[75] *Lesueurina* Fowler, Proc. Acad. Nat. Sci. Philadelphia, vol. 59, p. 440, fig. 9, 1908 (type species, *Lesueurella platycephalus* Fowler, misspelling for *Lesueurina platycephalus* Fowler).

[76] *Creedia* Ogilby, Proc. Linnean Soc. New South Wales, vol. 23, p. 298, 1898 (type species, *Creedia clathrisquamis* Ogilby).

[77] *Schizochirus* Waite, Rec. Australian Mus., vol. 5, pt. 4, p. 241, figs. 33, 34, pl. 26, fig. 3, 1904 (type species, *Schizochirus insolens* Waite).

8*b*. Scales about 35 to 40, large; dorsal fin origin about midway between snout tip and caudal fin base, and about one head length behind rear of head; lateral line along midside anteriorly gradually sloping closer to a more ventral position near rear of anal fin base; snout fleshy, projecting beyond lower jaw; dorsal rays 21 to 26; anal 23 to 29; pectoral 11 to 13; branched caudal 5+4. (Indo-Pacific.) **Limnichthys** Waite

4*b*. Origin of anal fin behind dorsal fin origin.

9*a*. Dorsal rays IV,20, first rays pungent spines; anal 15; pectoral 15; branched caudal 6+5 (fresh-water streams of New Zealand). **Cheimarrichthys**[79] Haast

9*b*. Dorsal fin without pungent spines.

10*a*. Inner edge of preopercle with cirri opposite the gill rakers on first gill arch; dorsal rays about 40 to 42; anal about 39 to 41; pectoral about 18 to 20; branched caudal fin rays 4+4; scales about 48 to 52; jaws nearly equal. (New Zealand; Indo-Pacific.) **Hemerocoetes**[80] Cuvier and Valenciennes

10*b*. No cirri on inner edge of the preopercle.

11*a*. Lips with cirri; snout fleshy, projecting; lateral line along midside anteriorly but ventral in position near caudal peduncle; pelvic rays I,4; anal origin nearly under that of dorsal; dorsal rays 34 to 37; anal 35 to 38; pectoral 11 or 12; branched caudal 4+3 or 4; scales 54 to 57. (Indo-Pacific.) **Chalixodytes** Schultz

11*b*. Lips without cirri; pelvic rays I,5.

12*a*. Snout fleshy, projecting; dorsal rays about 34 to 43; anal 35 to 39, branched caudal 4+4; anal origin under about base of fourth soft dorsal ray; scales 54 to 60. (Indo-Pacific.) **Crystallodytes**[81] Fowler

12*b*. Snout not fleshy and projecting.

13*a*. Jaws equal or upper slightly longest; dorsal rays about 28; anal 23; scales 30, with 3 above and 4 below lateral line. (Australia.)---------**Squamicreedia**[82] Rendahl

13*b*. Lower jaw longer than upper; branched caudal rays 6+5; pectoral 12 to 14; anal I,35 to 42; scales 50 to 60, with 4 or 5 above and 5 or 6 below lateral line; gill rakers

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[78] *Tewara* Griffin, Trans. New Zealand Inst., vol. 63, p. 174, pl. 25, upper fig., 1933 (type species, *Tewara cranwelli* Griffin; from Cable Bay).

[79] *Cheimarrichthys* Haast, Trans. New Zealand Inst., vol. 6, p. 103, pl. 18, 1874 (type species, *Cheimarrichthys forsteri* Haast).—McCulloch and Phillipps, Rec. Australian Museum, vol. 14, No. 1, p. 19, pl. 4, fig. 2, 1923 (New Zealand).

[80] *Hemerocoetes* Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 12, p. 311, 1837 (type species, *Hemerocoetes acanthorhynchos* Cuvier and Valenciennes=*Callionymus acanthorhynchos* Forster=*C. monopterygius* Bloch and Schneider).—Waite, Rec. Canterbury Mus., vol. 1, No. 3, p. 245, pl. 54, fig. 1, 1911 (description and figure of type species).

The following species belong in this genus: *Hemerocoetes microps* Waite, Rec. Canterbury Mus., vol. 1, No. 3, p. 245, pl. 54, fig. 2, 1911 (type locality, southwest coast of New Zealand). *Hemerocoetes waitei* Regan *in* British Antarctic (*Terra Nova*) Expedition, Zoology, vol. 1, No. 1, p. 18, 1914 (type locality, New Zealand).

[81] *Crystallodytes* Fowler, Occ. Pap. Bishop Mus. vol. 8, No. 7, p. 390, 1923 (type species, *Crystallodytes cookei* Fowler).

[82] *Squamicreedia* Rendahl, Svenska Vet. Akad. Handl., vol. 61, No. 9, p. 20, figs. 4, 5, 6, 1921 (type species, *Squamicreedia obtusa* Rendahl).

6 or 7+1+20 to 24; first 2 or 3 dorsal rays long and filamentous on males, but about the same length as other rays on females; 4 or 5 small scales around lower rear edge of eye.

14*a*. Dorsal rays III–44 to 46; scales in front of anus on midventral part of abdomen crowded or notably smaller than those laterally. **Trichonotops**,[83] new genus

14*b*. Dorsal rays VI or VII,40 to 43. (The differences between the spines and soft rays can be detected only by use of a microscope and transmitted light); scales not crowded or smaller on ventral part of abdomen in front of anus---**Trichonotus** [84] Bloch and Schneider

3*b*. Two dorsal fins, first few rays detached from the posterior rays; pelvic rays I,5 (Percophididae).

15*a*. Opercle with a single spine (sometimes rather weak and not projecting, represented by a ridge) near its dorsal edge; this spine may be covered with scales.

16*a*. Lower jaw projecting, notably longer than upper jaw, body greatly elongate, greatest depth about 10 times or more in standard length; head greatly depressed; no cirri on inner edge of preopercle; dorsal rays VIII or IX–31; anal about i,38 to i,40; pectoral about 17 or 18; branched caudal 6+5. (Tropical Atlantic.) **Percophis** [85] Quoy and Gaimard

16*b*. Lower jaw a little shorter than upper jaw or equal to it; greatest depth 8 or fewer times in standard length.

17*a*. Dorsal rays IV to VI–20 to 23; branched caudal 4+3 or 4.

18*a*. Inner edge of preopercle with a row of cirri that interdigitate with gill rakers on first gill arch; dorsal rays VI–21 to 23; anal 27; scales 34 to 36, with 2 scales above and 3 below lateral line. (Indo-Pacific.) **Pteropsaron** [86] Jordan and Snyder

18*b*. Inner edge of preopercle without cirri; anal rays about 24.

19*a*. Cleft of mouth almost horizontal, very slightly oblique; dorsal rays IV–21; scales 32, with 2 above lateral line and 3 below to anal origin. (Indo-Pacific.) **Osopsaron** [87] Jordan and Starks

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[83] Type species, *Taeniolabrus marleyi* Smith, Trans. Roy. Soc. South Africa, vol. 24, pt. 1, p. 4; pls. 1, 2, 1936 (type locality, Durban, South Africa).

My diagnosis of this new genus is based on Smith's description of *T. marleyi*, and on a specimen (loaned by Dr. R. R. Harry), SNHM 31451, from Durban Bay, Natal, South Africa.

[84] *Trichonotus* Bloch and Schneider, Systema ichthyologiae . . ., p. 179, pl. 39, 1801 (type species, *Trichonotus setiger* Bloch and Schneider).

Taeniolabrus Steindachner, Sitzb. Akad. Wiss. Wien, vol. 55, No. 1, p. 713, pl. 3, fig. 5, 1867 (type species, *Taeniolabrus filamentosus* Steindachner).

[85] *Percophis* Quoy and Gaimard, Voyage autour du monde . . . sur . . . l'*Uranie* et la *Physicienne*, Zoologie, p. 351, pl. 53, figs. 1, 2, 1824 (type species, *Percophis brasiliensis* Quoy and Gaimard).

[86] *Pteropsaron* Jordan and Snyder, Proc. U. S. Nat. Mus., vol. 24, No. 1263, p. 470, fig. 2, 1902 (type species, *Pteropsaron evolans* Jordan and Snyder).—Jordan and Starks, Bull. U. S. Fish Comm., vol. 22 (1902), p. 599, fig., 1904 (Japan).

[87] *Osopsaron*, Jordan and Starks, Bull. U. S. Fish Comm., vol. 22 (1902), p. 600, fig., 1904 (type species, *Pteropsaron verecundum* Jordan and Snyder).

Pteropsaron verecundum Jordan and Snyder, Proc. U. S. Nat. Mus., vol. 24, p. 472, 1902 (type locality, Suruga Bay, Japan).

19*b*. Cleft of mouth oblique; dorsal rays V or VI–20 or 21; scales 33, with 3 above and 4 below lateral line. (Arafura Sea, off Northern Australia.)---- **Acanthaphritis** [88] Günther

17*b*. Dorsal rays II or III–15 to 18; anal rays about 24; branched caudal fin rays 4+3 or 4.

20*a*. Outer edge of anterior nasal opening ringed with inward projecting cirri; lateral line along midside of body; dorsal rays III–15 or 16; scales 29, with 3 above and 4 below lateral line. (Indo-Pacific.)-------------**Cirrinasus**, [89] new name

20*b*. Outer edge of nasal openings without cirri; dorsal rays II or III–15 to 18; pectoral 15 or 16; scales about 32, with 2 above and 3 or 4 scales below lateral line. (Hawaiian Islands; Australia.)--------------**Enigmapercis** [90] Whitley

15*b*. Opercle with 2 spines; subopercle with a single spine; branched caudal fin rays 6+5; dorsal rays VI–14 to 18; scales 50 to 71.

21*a*. No dermal tentacle on maxillary. Pectoral rays 21 to 23.

22*a*. Space between mandibular rami naked. (Hawaiian Islands.) **Chrionema** [91] Gilbert

22*b*. Space between mandibular rami scaled. (Virgin Islands, West Atlantic; Hawaiian Islands in Pacific.)-**Chriomystax** [92] Ginsburg

21*b*. A dermal tentacle at rear edge of maxillary; pectoral rays about 23 to 28. (Atlantic and Indo-Pacific.)---**Bembrops** [93] Steindachner

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[88] *Acanthaphritis* Günther, in Report on . . . voyage of H. M. S. *Challenger* . . . 1873–76, Zoologie, vol. 1, pt. 6, Shore fishes, p. 43, pl. 18, fig. A, 1880 (type species, *Acanthaphritis grandisquamis* Günther).

[89] *Roxasella* Fowler, U. S. Nat. Mus. Bull. 100, vol. 14, pt. 2, p. 87, fig. 23, 1943 (type species, *Roxasella usiforme* Fowler, preoccupied by *Roxasella* Merino 1936 in Vermes; holotype USNM 99517).

Cirrinasus, new name, is hereby selected to replace *Roxasella* Fowler, type species, *Roxasella fusiforme* Fowler. Named in reference to the ring of cirri projecting into nasal openings.

[90] *Enigmapercis* Whitley, Proc. Roy. Zool. Soc. New South Wales 1935–1936, p. 19, 1936 (type species, *Enigmapercis reducta* Whitley); Rec. Australian Mus., vol. 20, No. 1, pp. 22–24, 1937 (description); Australian Mus. Mag., vol. 8, No. 8, p. 254, fig., 1944.

The following species belongs in this genus: *Pteropsaron incisum* Gilbert, Bull. U. S. Fish Comm., vol. 23 (1903), pt. 2, p. 647, pl. 87, 1905 (type locallity, Laysau Island, holotype USNM 51621).

[91] *Chrionema* Gilbert, Bull. U. S. Fish Comm., vol. 23 (1903), pt. 2, p. 645, pl. 85, 1905 (type species, *Chrionema chryseres* Gilbert).

[92] *Chriomystax* Ginsburg, Proc. U. S. Nat. Mus., vol. 104, No. 3347, p. 628, 1955 (type species, *Chriomystax squamentum* Ginsburg).

The following species belongs in this genus: *Chrionema squamiceps* Gilbert, Bull. U. S. Fish Comm., vol. 23 (1903), pt. 2, p. 646, pl. 86, 1905 (type locality, Maui; holotype USNM 51635).

[93] *Bembrops* Steindachner, Sitzb. Akad. Wiss. Wien, vol. 74, p. 163, 1876 (type species, *Bembrops caudimacula* Steindachner).

Hypsicometis Goode, Proc. U. S. Nat. Mus., vol. 3, p. 347, 1880 (type species, *Hypsicometis gobioides* Goode, off Long Island; holotype USNM 26007).

Bathypercis Alcock, Journ. Asiatic Soc. Bengal, vol. 62, No. 2, p. 177, pl. 9, fig. 1, 1893 (type species, *Bathypercis platyrhynchus* Alcock).

The following species also belong to this genus: *Bembrops adenensis* Norman and *B. nematopterus* Norman, in John Murray Expedition 1933–34, Scientific Reports, vol. 7, No. 1, Fishes, pp. 68–70, figs. 24A–C, 1939 (type localities, Gulf of Aden and Zanzibar area, respectively. *B. magnisquamis* Ginsburg, Proc. U. S. Nat. Mus., vol. 104, No. 3347, p. 633, 1955 (type locality, Cuba and Virgin Islands). *B. macromma* Ginsburg, Proc. U. S. Nat. Mus., vol. 104, No. 3347, p. 634 (type locality, Virgin Islands). *B. anatirostris* Ginsburg, Proc. U. S. Nat. Mus., vol. 104, No. 3347, p. 635, fig. 120 (type locality, off Mississippi Delta and Gulf of Mexico; Puerto Rico). *B. filifer* Fowler, Proc. U. S. Nat. Mus., vol. 85, No. 3032, p. 92, fig. 42, 1938 (type locality, Philippines; holotype USNM 98866, and many paratype lots). *B. filamentosa* Norman, John Murray Expedition, 1933–34, Scientific Reports, vol. 7, No. 1, Fishes, p. 70, 1939 (new name for *Bembrops filifer* Fowler, preoccupied). *B. philippinus* Fowler, Not. Naturae Acad. Nat. Sci., Philadelphia, No. 1, p. 2, 1939 (new name for *Bembrops filifer* Fowler).

Genus LIMNICHTHYS Waite

Limnichthys Waite, Rec. Australian Mus., vol. 5, pt. 3, p. 178, pl. 23, fig. 4, 1904 (type species, *Limnichthys fasciatus* Waite).

The species of *Limnichthys* are separated by the following key (See also table 107):

1*a*. Dorsal rays 25 or 26, anal 27 to 29 .... **L. fasciatus** Waite
1*b*. Dorsal rays 19 to 22, anal 23 to 25 .... **L. donaldsoni**, new species

LIMNICHTHYS DONALDSONI, new species

Figure 107

Holotype.—USNM 140906, Bikini Atoll, lagoon reef halfway between Bikini and Amen Islands, July 21, 1947, S-46-442, Brock, Hiatt, and Schultz, standard length 17.5 mm.

Paratypes.—USNM 140909, Eniwetok Atoll, Rujoru Island lagoon reef, June 2, S-46-195, Schultz, 1 specimen, 18 mm.; USNM 140908, Eniwetok Atoll, Aaraanbiru Island, ocean reef, June 3, S-46-198, Schultz, 1 specimen, 20 mm.; USNM 140907, Rongerik Atoll, Bock Island, ocean reef, June 27, S-46-237, Schultz and Herald, 2 specimens, 16 to 17 mm.; USNM 164422, Oahu, off Waikiki reef, Dec. 31, 1952, Gosline, Randall and Brock, 1 specimen, 21 mm.; USNM 164423, Oahu, off Waikiki, June 4, 1952, Gosline and Brock, 1 specimen, 21 mm.

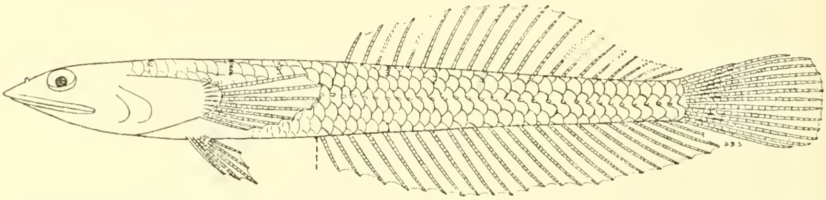

Figure 107.—*Limnichthys donaldsoni*, new species, holotype, USNM 140906. Drawn by Dorothea B. Schultz.

Description.—The following counts were made on the holotype and paratypes. Dorsal rays 22, 21, 19, 21, 21; anal rays 24, 24, 23, 24, 25; pectoral rays 11-11, 11-11, 11-11, 11, 11; pelvic rays always I, 5; pores in lateral line 36, 36, 37, 35, 37; predorsal scales 17, 17, 17, 18; 3 scales between lateral line and dorsal origin and 3 below to anal origin.

Precision measurements were made on the holotype and one paratype and these data, recorded below, are expressed in thousandths of the standard length. Standard length 17.5 and 16.3. Length of head 315 and 337; greatest depth of body 103 and 117; diameter of orbit 34 and 43; length of snout 69 and 61; tip of snout to rear edge of maxillary 126 and 135; postorbital length of head 200 and 196;

tip of snout to anus 458 and 497; tip of snout to dorsal origin 492 and 582; tip of snout to anal origin 459 and 484; length of pectoral fin 172 and 165; length of pelvics 103 and 98; length of caudal fin 212 and 215.

TABLE 107. *Counts recorded for certain species of* Trichonotidae

Genera and species	Fin rays																							
	Dorsal																			Pectoral			Pelvic	
	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	11	12	13	I,4	I,5
Chalixodytes tauensis:																								
Marshall Islands	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	2	4	2	---	7	1	8	---
Samoan Islands	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	2	2	3	1	3	3	---	8	---
Limnichthys:																								
fasciatus [1]	---	---	---	---	---	---	X	X	---	---	---	---	---	---	---	---	---	---	---	---	---	X	---	X
donaldsoni	2	---	3	2	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	7	1	---	---	9

Genera and species	Anal rays															
	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
Chalixodytes tauensis:																
Marshall Islands	---	---	---	---	---	---	---	---	---	---	---	---	1	5	2	---
Samoan Islands	---	---	---	---	---	---	---	---	---	---	---	---	2	4	1	1
Limnichthys:																
fasciatus	---	---	---	---	X	X	X	---	---	---	---	---	---	---	---	---
donaldsoni	1	3	2	1	---	---	---	---	---	---	---	---	---	---	---	---

[1] Counts from original description and figure.

Body elongate, slender, head depressed, tapering to a flattened projecting snout; lower jaw notably included; origin of dorsal fin a little behind a vertical line through anal fin origin; pelvics inserted a little in advance of base of pectoral fins; operculum elongated, membranous, and covering base of pelvic fins, gill membranes free from isthmus, joined to it far forward; lateral line along midaxis anteriorly, gradually becoming more ventrally located, and meeting its fellow at ventral base of caudal fin; each lateral line scale, at least posteriorly, with concave notch posteriorly and lower lobe longer than upper lobe of scale, the canal under lower lobe; body fully scaled; the slender maxillary slips under the preorbital; the slender pointed lower jaw has a series of cirri along its edges; minute teeth in a very narrow band on both jaws, on palatines and probably on the vomer; no cirri on operculum; eyes large, located dorsally, with the pupils placed anteriorly and directed forward; interorbital space convex, narrow; posterior nasal opening a pore at front margin of orbit, anterior nostril also a pore behind fleshy tip of snout; tongue free, long, slender, and pointed; anus close in front of anal origin; third and fourth pelvic soft rays longest.

Color in alcohol.—Whitish with about 9 narrow dark saddles on back, or they may be lacking, four of these occur in front of dorsal fin, and the first one near occiput is triangular in shape; head somewhat silvery. Eyes black, perhaps from formalin preservation.

Color when alive.—Translucent.

Ecology.—*L. donaldsoni* is a sand burrowing species.

Remarks.—This new species differs from the only other species of the genus, *L. fasciatus*, by having fewer dorsal and anal rays, 19 to 21 dorsal and 23 to 26 anal instead of 25 or 26 dorsal and 27 to 29 anal rays. The occurrence of this species at Oahu indicates a wide range in the central Pacific.

Named in honor of Dr. Lauren R. Donaldson, School of Fisheries, University of Washington, who was at Bikini.

Genus CHALIXODYTES Schultz

Chalixodytes Schultz, U. S. Nat. Mus. Bull. 180, p. 262, fig. 24, 1943 (type species, *Chalixodytes tauensis* Schultz).

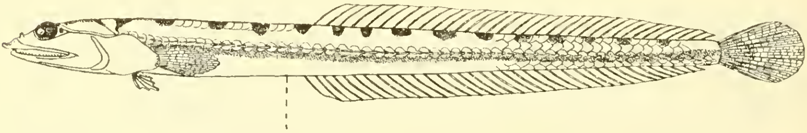

Figure 108.—*Chalixodytes tauensis* Schultz, holotype, USNM 116083. Drawn by A. M. Awl.

CHALIXODYTES TAUENSIS Schultz

Figure 108

Chalixodytes tauensis Schultz, U. S. Nat. Mus. Bull. 180, p. 263, fig. 24, 1943 (type locality, Tau and Tutuila Islands, Samoan group).

SPECIMENS STUDIED

Bikini Atoll: 5 stations, 9 specimens, 25 to 40 mm. in standard length.
Rongerik Atoll: 126 specimens, 16 to 39 mm.
Rongelap Atoll· 25 specimens, 13 to 35 mm.
Eniwetok Atoll. 1 specimen, 30 mm.

Description. -Dorsal rays 35 to 37; anal rays 35 to 37; pectoral with a tiny nonstriated ray and 11 or 12 cross-striated rays; pelvics always I,4; pores from upper edge of gill opening to base of caudal fin 55 or 56; predorsal median scales about 18; branched caudal fin rays about 7 or 8.

Head 4.2, greatest depth about 10, tip of snout to dorsal origin about 2.3; all in standard length. Snout 3.8, eyes 7, length of pectoral fin 2.2, all in length of head.

Body long, slender, the depressed head tapering to a point, with snout projecting notably beyond lower jaw; origin of dorsal fin over that of the anal; pelvics inserted in front of base of pectorals; the membranous operculum is somewhat elongate, covering the base of the pectoral fin; the suboperculum and interoperculum have a notch that fits around the anterior base of pelvic fins; gill membranes free from isthmus, joined to it far forward; lateral line along midaxis anteriorly but follows a more ventral course posteriorly and meets its fellow at ventral side at base of caudal fin; body with scales posteriorly, naked anteriorly except for 3 predorsal rows of scales along back and scales along lateral line; sometimes the predorsal scales end before occiput; the slender maxillary slips into a groove under the dorsally placed eyes; the slender pointed lower jaw has a series of cirri along their edges; teeth of both jaws in a narrow villiform band, and similar teeth on palatines; probably no teeth on vomer; no cirri on operculum; eyes large, with the pupils placed anteriorly and directed forward; interorbital space concave, narrow; posterior nasal opening a pore at front margin of orbit, anterior nostril tubular; tongue narrow, free pointed, not bilobed; anus close in front of anal origin.

Color in alcohol.—Pale yellowish white, sometimes with about 16 short brownish saddles on back, or all pigment may be lacking except the black eyes; snout blackish occasionally; head somewhat silvery.

Color when alive.—Translucent.

Ecology.—These sand divers live buried in the loose coral sand on the bottoms between coral heads where the wave action is severe.

Remarks.—The range of *Chalixodytes tauensis* is herewith extended from the Samoan Islands to the Marshall Islands. No significant variations in counts were detected between the two widely separated regions (table 107).

Suborder BLENNIINA

Family CLINIDAE: Scaled Blennies

Subfamily TRIPTERYGIINAE

By LEONARD P. SCHULTZ

This subfamily consists of small scaled blennies, some species of which are abundant in those parts of the reefs where wave action is strong. Species of the Marshall and Marianas Islands in general may be recognized by their having 3 dorsal fins or at least the spiny dorsal having a deep notch between the two parts.

Because I could find no revision of the 49 or more species named for this relationship, and because much confusion existed in regard to the valid genera, I published a revisional key (Journ. Washington Acad. Sci. vol. 40, No. 8, pp. 267–268, 1950) in which I defined 5 genera, whereas Mukerji (Rec. Indian Mus., vol. 37, pp. 273–4, 1935) recognized only the genus *Tripterygion*. He lacked American and Mediterranean species for comparison and this may have handicapped his analysis. Perhaps there are other genera related to these scaled blennies that I have overlooked.

Clark Hubbs (Stanford Ichthyol. Bull., vol. 4, No. 2, p. 50, 1952) in a key defines the clinid families, of which one is the Tripterygiidae, he places in the superfamily Blenniicae. One of his characters is II anal spines, but I (1950) find even among the American species of the genus *Tripterygion* I or II anal spines.

J. L. B. Smith (Ann. Mag. Nat. Hist. ser. 11, vol. 12, pp. 535–546, figs. 1–4, 1945; and vol. 14, pp. 732–736, figs. 1, 2, 1947) defined new genera and species of Clinidae from South Africa and gave a key to the genera of that region. It is possible that his *Blennioclinus stella* Smith, and *Labroclinus* Smith are related to *Tripterygion*. Specimens were not available for study.

Scott published (Pap. Proc. Roy. Soc. Tasmania, vol. 89, pp. 137–138, 1955) a key to the Clinidae of Tasmania which is a refinement of his key published in 1939. He recognizes 5 genera and describes as new *Clinus puellarum*.

KEY TO THE GENERA OF CLINIDAE CLOSELY RELATED TO TRIPTERYGION

1*a*. First dorsal with III to VII spines, notably separated from second spiny dorsal fin, or the membrane is incised to base forming two distinct spiny dorsal fins.

  2*a*. First dorsal fin with V to VII spines, second dorsal with about XIX to XXII spines; anal with about II, 25 to 27; pectoral rays about 17 to 19; vertical scale rows about 60 to 65; lateral line, anteriorly, separated from base of second spiny dorsal by 5 or 6 scales; breast scaly; head naked ---------------------- **Forsterygion**[94] Whitley and Phillipps

  2*b*. First dorsal fin with III or IV spines; second with X to XVII; dorsal soft rays 6 to 15; anal I or II, 13 to 26; scales in about 20 to 45 vertical rows.

    3*a*. Lateral line represented by pores anteriorly, and convexly curved (sometimes nearly straight) above pectoral fin, separated by 2 to 5 scales from base of spiny dorsal fins, and ending from opposite base of second dorsal to opposite front of base of soft dorsal, thence commencing 1 or 2 scales below and continuing as notched scales along midlengthwise axis of body.

      4*a*. Pectoral rays 14 to 16; 2 or 3 scales between anterior lateral line and base of second dorsal; first dorsal usually with III, occasionally IV, spines ------------------------------- **Tripterygion Risso**

      4*b*. Pectoral rays usually 11; 4 or 5 scales between anterior lateral line and base of second dorsal; dorsal rays IV–X–12 or 13; anal I,22 or 23; lateral line pores 15+25 --------------- **Notoclinus**[95] Gill

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[94] *Forsterygion* Whitley and Phillipps, Trans. Roy. Soc. New Zealand, vol. 69, No. 2, p. 236, 1939 (type species, *Blennius varius* Bloch and Schneider = *Tripterygion nigripenne* Cuvier and Valenciennes, probably = *Tripterygion capito* Jenyns, Zoology of the voyage of H. M. S. *Beagle*, pt. 4, Fish, pp. 94–95, pl. 19, fig. 1, 1842 (Bay of Islands, New Zealand).

[95] *Notoclinus* Gill, Mem. Nat. Acad. Sci. vol. 6, pp. 95–124, 1893 (type species, *Tripterygion fenestratum* = *Blennius fenestratus* Bloch and Schneider). Gill based the genus *Notoclinus* on a large specimen of *fenestratum* in the U. S. National Museum from New Zealand, USNM 39672, which measures 180 mm. in standard length.

Dr. Richard Rosenblatt, who is revising this subfamily, in a letter dated August 1, 1957, informed me that this genus should be referred to the subfamily Clininae.

3*b*. Lateral line concavely curved downward behind pectoral fin, separated by 4 to 8 scales from base of second spiny dorsal fin, thence continuing along midlengthwise axis of body, the last scales sometimes notched posteriorly-------**Helcogramma** McCulloch and Waite

1*b*. First dorsal of III or IV spines, separated from following spines by a notably wider than usual space, but membrane continuous, forming a single spiny dorsal fin; no cirri on eye or on nape; dorsal rays about III,XIV–12; anal II,17; head naked, about 7 scales in a row from lateral line to middle of base of spiny dorsal; lateral line curving downward behind pectoral fin, thence extending along midlengthwise axis of body. **Lepidoblennius**[96] Steindachner

Genus TRIPTERYGION Risso

Tripterygion Risso, Histoire naturelle des principales productiones de l'Europe Meridionale . . ., vol. 3, p. 241, 1826 (type species, *Tripterygion nasus* Risso=*Blennius tripteronotus* Risso 1810).

Enneapterygius Rüppell, neue Wirbethiere zu der Fauna von Abyssinien gehörig, Fische, p. 2, pl. 1, fig. 2, 1835 (type species, *Enneapterygius pusillus* Rüppell).

Enneanectes Jordan and Evermann *in* Jordan, Proc. California Acad. Sci., ser. 2, vol. 5, p. 501, pl. 53, 1895 (type species, on pl. 53, "*Enneanectes carminalis*" not of Jordan and Gilbert=*Gillias sexmaculatus* Fowler 1941; *Tripterygium carminale* Jordan and Gilbert, holotype USNM 120946, was found by me with the types of *Gobiesox zebra* in 1944 and belongs to the genus *Helcogramma*, as indicated in this study).

Gillias Evermann and Marsh, Rep. U. S. Comm. Fish., vol. 25 (1899), p. 357, 1900 (type species, *Gillias jordani* Evermann and Marsh).

Trianectes McCulloch and Waite, Rec. South Australian Mus. vol. 1, No. 1, p. 53, 1918 (type species, *Trianectes bucephalus* McCulloch and Waite).

Notoclinops Whitley, Mem. Queensland Mus. vol. 10, No. 1, p. 20, 1930 (type species, *Tripterygion segmentatum* McCulloch and Phillips).

Verconectes Whitley, Australian Zool. vol. 6, No. 1, p. 324, 1931 (type species, *Tripterygion bucephalus* McCulloch and Waite; proposed to replace *Trianectes*, said by Whitley to be preoccupied but is not).

Vauclusella Whitley, Australian Zool. vol. 6, No. 4, p. 324, 1931 (type species, *Tripterygion annulatum* Ramsay and Ogilby).

Hubbs and Springer (Bull. Marine Sci. Gulf and Caribbean, vol. 4, No. 4, pp. 346–350, 1954) have determined the status of *Gobioclinus* Gill, type species, *Clinus gobio* Cuvier and Valenciennes. Longley (*in* Longley and Hildebrand, Carnegie Inst. Washington Publ. 535, p. 257, 1941) selected the *Labrisomus* specimen as the lectotype of *Clinus gobio* and he considered the other four types to represent *Tripterygion jordani* (Evermann and Marsh). Thus *Gobioclinus* is a synonym of *Labrisomus*, not *Tripterygion* as first supposed by Clark Hubbs (Stanford Ichthyol. Bull. vol. 4, No. 2, p. 102, 1952, and Zoologica, New York Zool. Soc., vol. 38, p. 114, 1953).

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[96] *Lepidoblennius* Steindachner. Sitzb. Akad. Wiss. Wien, vol. 55, p. 3, 1867 (type species, *Lepidoblennius haplodactylus* Steindachner).

TABLE 108.—*Certain counts made on various species of* Tripterygion

Genus and species	Fin rays																															
	Dorsal												Anal											Pectoral								
	First		Second						Soft or third				I	II	14	15	16	17	18	19	20	21	22	ii	iii	iv	4	5	6	7	vi	vii
	III	IV	X	XI	XII	XIII	XIV	XV	8	9	10	11																				
Tripterygion:																																
hemimelas	22				4	18				13	9		18					6	14	1				3	7	3	1	5	6	1	1	12
minutus	18		8	5	3	2			6	12			17			4	11	2							3	5	5	3			2	6
nanus	18			2	7	9				12	6		23				9	7	5	2					9	5	4	5	5			14
brachylepis		1					1			1				1						1					1				1		1	

	Pores in anterodorsal lateral line													Notched scales in posterior lateral line							Total vertical rows of scales above lateral line													
	11	12	13	14	15	16	17	18	19	20	21	22	23	16	17	18	19	20	21	22	30	31	32	33	34	35	36	37	38	39	40	41	42	43
Tripterygion:																																		
hemimelas						8	8	2	1					3	7	8	1						1	3	9	4	2							
minutus	3	2	6														2	6	3		1	2	2	4	2									
nanus	2	7	4														5	6	2		1	3	5	4										
brachylepis				1																1							1							

KEY TO THE SPECIES OF TRIPTERYGION OF THE MARSHALL AND MARIANAS ISLANDS

1*a*. Head and pectoral fin base without scales, breast naked.

  2*a*. Pores in anterodorsal lateral line 16 to 19, with 16 to 19 notched scales in posterior lateral line; one small cirrus on each eye. **T. hemimelas** Kner and Steindachner

  2*b*. Pores in anterodorsal lateral line 11 to 14, with about 19 to 21 notched scales in posterior lateral line.

    3*a*. Pectoral fin with 3 or 4 small brownish pigment spots; males with lower parts of head dark and dark pigment cells generally behind head on body and on pectoral fins-------------**T. minutus** Günther

    3*b*. Pectoral fin without pigment spots; males with lower parts of head blackish, but body behind pelvics is unpigmented; females unpigmented---------------------------------**T. nanus**, new species

1*b*. Scales on preopercle, opercle, pectoral fin base, and on area of abdomen in front of anus; dorsal rays IV–XIV–9; anal II,19; pores in anterior lateral line 14+22 in posterior one; 8 scales in a zigzag row around caudal peduncle; a broad orbital tentacle on each eye. **T. brachylepis**, new species

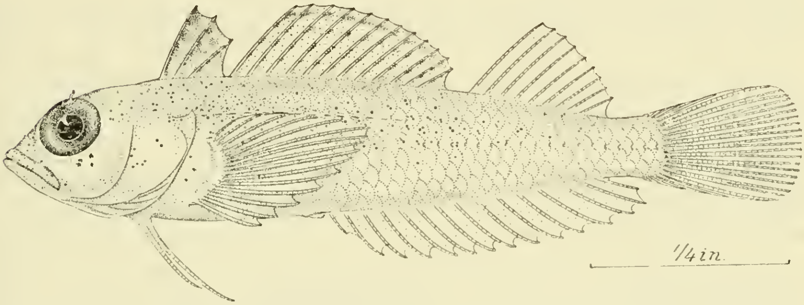

Figure 109.—*Tripterygion hemimelas* Kner and Steindachner, female, USNM 50719, after Jordan and Seale.

TRIPTERYGION HEMIMELAS Kner and Steindachner

Figure 109

Tripterygium hemimelas Kner and Steindachner, Sitzb. Akad. Wiss. Wien, vol. 54, pt. 1, p. 371, 1866 (type locality, Samoan Islands).

Enneapterygius cerasinus Jordan and Seale, Bull. U. S. Bur. Fish., vol. 25 (1905), p. 419, fig. 100, 1906 (type locality, Apia, Samoa; USNM 51802, a female).

Tripterigion atriceps Jenkins, Bull. U. S. Fish Comm., vol. 22 (1902), p. 505, fig. 46, 1903 (type locality, Honolulu; holotype USNM 50719, a male, and paratypes USNM 51165 and 126693).

Enneapterygius fuligicauda Fowler, Proc. Acad. Nat. Sci. Philadelphia, vol. 98, p. 188, fig. 52, 1946 (male; Riu Kiu Islands; ANSP 72062–64, types studied).

Enneapterygius macrobrachium Fowler, Proc. Acad. Nat. Sci. Philadelphia, vol. 98, p. 189, fig. 53, 1946 (female; type locality, Riu Kiu Islands; ANSP 72065, holotype, studied).

SPECIMENS STUDIED

Bikini Atoll: 5 stations, 9 specimens, 12 to 20 mm. in standard length.
Rongerik Atoll: 3 stations, 4 specimens, 19.5 to 21 mm.

Rongelap Atoll: 2 stations, 2 specimens, 18 to 25 mm.
Guam: 1 lot, 6 specimens, 19 to 27 mm.
Saipan: 1 lot, 1 specimen, 18 mm.

Description.—Dorsal rays III–XII or XIII–9 or 10; anal I,17 to 20; pectoral ii to iv,4 to 7,vi or vii; pores in lateral lines 16 to 19+16 to 19; pelvics I,2; branched caudal rays 5+4 or 5; 3 scales between upper lateral line and middle of base of second dorsal and usually 5 scales between anal origin and lateral line; one small cirrus on each eye, dorsally; one small cirrus on dorsal edge of anterior nostril. Head 3.0 to 3.2, greatest depth 4.0 to 4.2, longest pectoral ray (tenth or eleventh from dorsal edge of fin) 3.1 to 3.4; snout to anus 2.0 to 2.1; all in standard length. Snout 3.4 to 3.5; eye 3.0 to 3.9; postorbital length of head 2.0 to 2.1; least depth of caudal peduncle 3.0 to 3.3; greatest depth 1.3 to 1.4; all in length of head. Bony interorbital space 2.0 to 3.0 in eye.

Body scaled, head naked, no scales on fins; base of pectoral naked; breast naked; two lateral lines, upper about 3 scale rows below base of spiny dorsal and ending about opposite base of last dorsal spine, posterior lateral line of smaller pores along midlengthwise axis of body; gill membranes free from isthmus and broadly connecting across it; three dorsal fins, first two of spines, last of soft rays; inner ray of pelvic fin longest; first unbranched and a little enlarged; lower pectoral ray longest, not quite reaching to rear end of dorsal lateral line; last dorsal and last anal ray membranously free from caudal peduncle; vertical line through first dorsal origin passes in front of pectoral base and through rear edge of pelvic base; vertical line through anal origin passes through base of about fifth from last dorsal spine; maxillary reaching to under front edge of eye; snout pointed; small teeth in a band on both jaws, with an outer row of somewhat enlarged teeth; teeth in a triangular-shaped patch on vomer; a few teeth anteriorly on palatines; females may be recognized by the presence of a short and minutely papillate anal organ projecting a very short distance.

Color in alcohol.—Males brownish on underside and lower sides of head, on pectoral fin base and region of isthmus, including pelvic bases, and on caudal fin. Females plain pale, occasionally a few brown pigment cells dorsally on body, but not on head.

Ecology.—This species occurred in those collections made in the ocean surf and where the wave action was strong at the outer edge of the reef.

TRIPTERYGION MINUTUS Günther

FIGURES 110, 111

Tripterygium minutum GÜNTHER, Journ. Mus. Godeffroy, vol. 4, pt. 13, p. 211, pl. 118, fig. D, 1877 (type locality, Apia, Samoa).

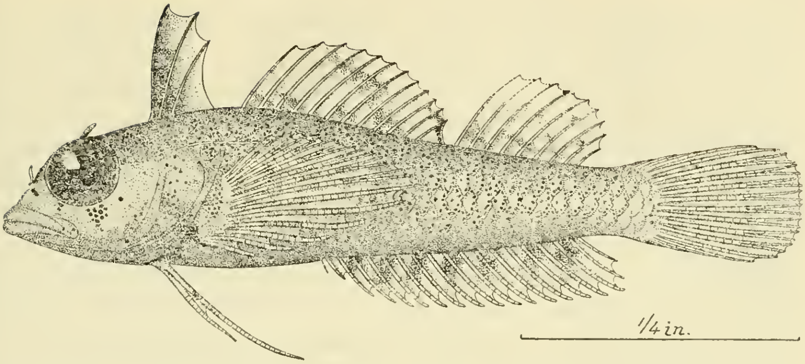

FIGURE 110.—*Tripterygion minutus* Günther, female, USNM 51801, after Jordan and Seale.

Enneapterygius tutuilae JORDAN and SEALE, Bull. U. S. Bur. Fish., vol. 25 (1905), p. 418, fig. 99, 1906 (type locality, Pago Pago; holotype, USNM 51801, 2 females).

Enneapterygius tusitalae JORDAN and SEALE, Bull. U. S. Bur. Fish., vol. 25 (1905), p. 416, fig. 97 (type locality, Pago Pago and Apia, Samoa; holotpye, USNM 51800).

Enneapterygius pardochir JORDAN and SEALE, Bull. U. S. Bur. Fish., vol. 25 (1905), p. 417, fig. 98 (type locality, Pago Pago, Samoa; holotype, USNM 51799, paratype, USNM 126235).

Enneapterygius punctulatus HERRE, Field Mus. Nat. Hist. Zool. Ser., vol. 18, No. 12, p. 432, 1935; and vol. 21, p. 397, fig. 37, 1936 (type locality, Vala Islands, New Hebrides).

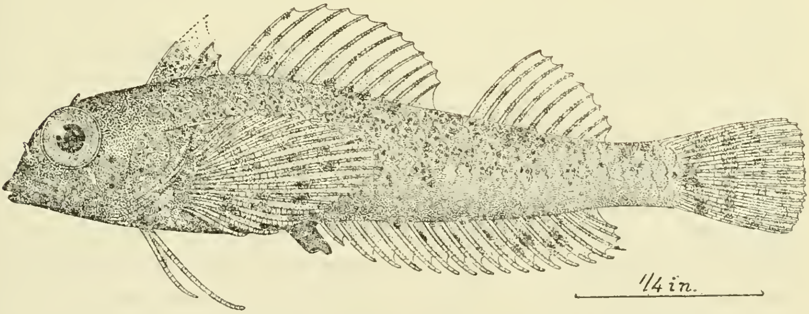

FIGURE 111.—*Tripterygion minutus* Günther, male, USNM 51799, after Jordan and Seale.

SPECIMENS STUDIED

Bikini Atoll: 3 stations, 7 specimens, 15 to 21 mm. in standard length.
Eniwetok Atoll: 1 station, 2 specimens, 13 to 19 mm.
Rongelap Atoll: 1 station, 8 specimens, 13 to 20 mm.

Description.—Additional counts not summarized in table 108 are here recorded: Pelvics I,2; scales between upper lateral line and middle of base of second dorsal 2, and between anal origin and lower lateral line 4; one cirrus on each eye; one small nasal cirrus on dorsal edge of anterior nostril. Head 3.3 to 3.5; greatest depth 5.0 to 5.2; longest pectoral ray (about ninth from dorsal edge) 2.7 to 2.9; snout to anus 2.3; all in standard length. Snout 3.5 to 3.7; eye 3.3 to 3.8; postorbital length of head 2.0 to 2.1; least depth of caudal peduncle 3.5 to 4.0; greatest depth 1.5 to 1.6; all in length of head. Bony interorbital space 2.7 to 3.0 in eye.

Body scaled, head, breast, fins, and pectoral base naked; two lateral lines, upper one about 2 scale rows below base of spiny dorsal and ending about opposite base of third or fourth from last dorsal spine; posterior lateral line of notched scales along midlengthwise axis of body; gill membranes free and broadly connected across isthmus; three dorsal fins, last of soft rays; inner pelvic ray longest; first unbranched and enlarged lower pectoral ray longest and notably reaching past dorsal lateral line to about opposite rear of base of second dorsal; last dorsal and anal ray membranously free from caudal peduncle; vertical line through dorsal origin passes through pelvic base; vertical line through anal origin passes through bases of fifth or sixth from last dorsal spine; rear edge of maxillary a little behind a vertical line through front of eye; small teeth in a band on both jaws with outer row a little enlarged; teeth in an angular patch on vomer and some small teeth on palatines; females have a short, minutely papillate anal organ projecting a short distance.

Color in alcohol.—Males have lower part of head moderately pigmented with brown and remainder of body more sparsely so; caudal fin dark brown or blackish, sometimes with a few cross bars; other fins dusky; pectoral fin with 3 or 4 small dark brown pigment spots. Females are usually plain pale with 3 or 4 small brown pigment spots on pectoral fin.

Ecology.—This tiny blenny was not abundant in the reefs and when taken usually occurred in areas where the wave action was strong.

Remarks.—I have reexamined the Phoenix and Samoan Islands specimens, including the types of Jordan and Seale, several of which were not available at the time of my Phoenix Island report (U. S. Nat. Mus. Bull. 180, 1943), and again I refer that material to this species. Jordan and Seale described males and females as separate species.

TRIPTERYGION NANUS, new species

FIGURE 112

Holotype.—USNM 142233, Eniwetok Atoll, Rujoru Island, lagoon reef, June 2, S–46–195, Schultz, standard length 16 mm., male.

Paratypes.—USNM 142247, Bikini Atoll, lagoon reef halfway between Bikini and Amen Islands, July 21, 1947, S–46–442, Brock, Hiatt, and Schultz, 4 specimens, 10 to 18 mm.; USNM 142246, Bikini Atoll, Bikini Island, western end, lagoon, August 18, 1947, S–42–533, Brock and Schultz, 1 specimen, 15 mm.; USNM 142245, Bikini Atoll, May 1946, Johnson, 2 specimens, 15 to 17 mm.; USNM 142237, Eniwetok Atoll, Rigili Island, lagoon reef, May 30, S–46–189, Schultz, 2 specimens, 16 mm.; USNM 142234, Eniwetok Atoll, Rujoru Island, lagoon reef, June 2, S–46–195, Schultz, 7 specimens, 10 to 18 mm.; USNM 142235, Eniwetok Atoll, Teiteiripucchi Island, lagoon reef, June 1, S–46–197, Schultz, 4 specimens, 12 to 17.5 mm.; USNM 142236, Eniwetok Atoll, Aaraanbiru Island, ocean reef, June 3, S–46–198, Schultz, 2 specimens, 16 to 17 mm.; USNM 142244, Rongerik Atoll, Bock Island, ocean reef, June 27, S–46–237, Schultz and Herald, 4 specimens, 16 to 18 mm.; USNM 142248, Rongelap Atoll, Arbor Island, June 16, S–46–213, Schultz, 1 specimen, 19 mm.; USNM 142239 Rongelap Atoll, Eniaetok Island, lagoon reef, June 17, S–46–215, Schultz, 3 specimens, 14 to 16 mm.; USNM, Rongelap Atoll, Enybarbar Island, ocean reef, high tidal channels, June 18, S–46–216, Schultz, 1 specimen, 15 mm.; USNM 142238, Rongelap Atoll, Enybarbar Island, isolated tidal pools, June 18, S–46–217, Schultz, 2 specimens, 18 mm.; USNM 142240, Rongelap Atoll, Kabelle Island, lagoon reef, June 20, S–46–231, Schultz and Herald, 1 specimen, 15 mm.; USNM 142241, Rongelap Atoll, pass between Eniaetok and Erapuotsu Islands, lagoon reef, July 20, S–46–267, Herald and Brock, 1 specimen, 14 mm.; USNM 142242, Rongelap Atoll, Rongelap Island, lagoon coral head, depth 18 feet, July 25, S–46–286, Brock, Herald and Kohler, 4 specimens, 14 and 15 mm.; USNM 142243, Kwajalein Atoll, Ennylabegan Island, lagoon reef, Sept. 1, S–46–397, Herald, 1 specimen, 7 mm.

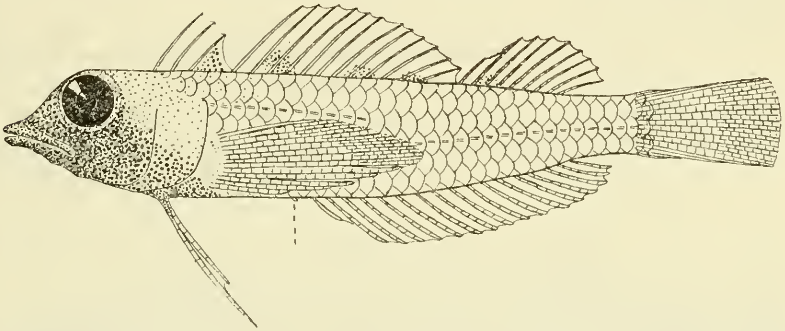

FIGURE 112.—*Tripterygion nanus*, new species, holotype, USNM 142233, from Eniwetok Atoll. Drawn by A. M. Awl.

Description.—Detailed measurements were made on the holotype and one female paratype and these data, expressed in thousandths of the standard length are recorded, respectively: Standard length in mm. 16 and 19.2. Length of head 344 and 302; greatest depth 200 and 172; least depth of caudal peduncle 87 and 73; snout 94 and 89; eye 87 and 89; tip of snout to rear edge of maxillary 106 and 99; bony interorbital space 25 and 26; postorbital length of head 131 and 135; snout tip to dorsal origin 244 and 240, to anus 456 and 453, to pelvic insertion 238 and 208. Longest ray of first dorsal 100 and 89, second dorsal 144 and 130, third dorsal 119 and 115, pectoral 319 and 297, pelvics 250 and 224, anal 125 and 110, caudal 219 and 219.

Counts on the holotype and one female paratype were respectively: Dorsal III–XII–9 and III–XII–10; anal I,16 and I,18; pectoral iv,4,vii–iv,4,vii and iv,4,vi–iv,4,vi; pelvics always I,2; branched caudal fin rays 5+4 and 5+4; scales in dorsoanterior lateral line 11 and 12 and in posterior lateral line 19 and 19; vertical scale rows 30 and 31; zigzag scales around caudal peduncle 8 and 8.

Additional counts not summarized in table 108 are: Pelvics I,2; branched caudal fin rays usually 5+4 or 5; scales between upper lateral line and middle of base of second dorsal 2, and between anal origin and lower lateral line 4; one cirrus on each eye; one small nasal cirrus on dorsal edge of anterior nostril. Head 3.1 to 3.2; greatest depth 4.6 to 4.8; longest pectoral ray (about eighth from dorsal edge) 2.6 to 3.0; snout to anus 2.1 to 2.3; all in standard length. Snout 3.5 to 3.6; eye 3.5 to 4.2; postorbital length of head 2.2; least depth of caudal peduncle 3.2 to 3.6; greatest depth 1.5; all in length of head. Bony interorbital space 2.2 to 2.3 in eye.

Body scaled, head and breast naked; no scales on fins or base of pectoral; two lateral lines; upper one about 2 scale rows below base of spiny dorsal and ending about opposite base of fifth or sixth from last dorsal spine; posterior lateral line along midlengthwise axis of body; gill membranes free from isthmus, broadly connecting across isthmus; three dorsal fins, first two of spines, last of soft rays; inner ray of pelvics longest, first unbranched and enlarged lower pectoral ray longest, notably reaching past rear end of dorsal lateral line; last dorsal and last anal ray membranously free from caudal peduncle; vertical line through first dorsal origin passes a trifle in front of pectoral base and through rear edge of pelvic base; vertical line through anal origin passes through base of about sixth from last dorsal spine; maxillary reaching a trifle past a vertical line through front of eye; snout pointed; small teeth in a band on both jaws, with outer row a little larger; teeth in an angular patch on vomer and a few teeth on palatines; females have a short, minutely papillate anal organ projecting a short distance.

Color in alcohol.—Males have lower part of head and pectoral base and isthmus, including pelvic bases, brownish; caudal fin not brownish, but sometimes with very faint dusky bars; no dark spots on pectoral fins. Females are everywhere plain pale, with no dark spots on pectoral fin.

Ecology.—This reef-inhabiting species was taken in areas of strong wave action, down to a depth of 18 feet and in high isolated shallow tidal pools. Our longest specimen measures 19 mm. Mature females measure about 14 to 19 mm. in standard length and contain about a dozen eggs rather large for such a tiny species.

Remarks.—This new species is most closely related to *T. minutus* but differs in coloration and in other characters. *T. minutus* has a few brown pigment spots on the pectoral fins of females whereas the females of *nanus* have plain unspotted pectoral fins. The males of *nanus* have the lower parts of the head with dark pigment (ending on base of pelvics), whereas in *minutus* the entire body may have numerous scattered pigment cells. Pectoral fins of males of *nanus* are unpigmented, whereas those of *minutus* have dark pigment usually arranged to form spots or transverse bars.

The females of *nanus* at lengths of 14 to 19 mm. have about a dozen mature eggs, whereas females of *minutus* mature at a larger size and contain 2 or 3 dozen much smaller mature eggs.

Named *nanus* in reference to the dwarf size of this species.

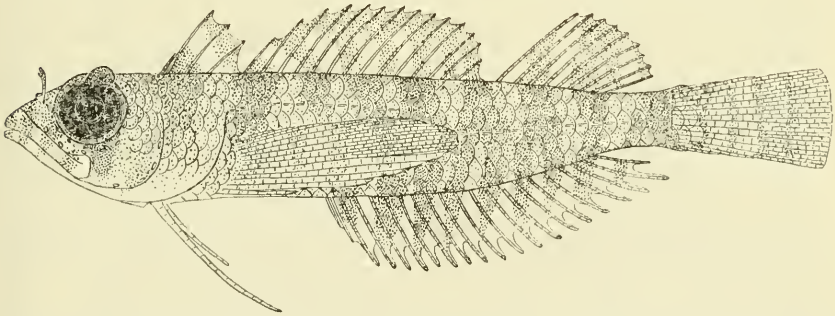

FIGURE 113.—*Tripterygion brachylepis*, new species, holotype, USNM 142253. Drawn by A. M. Awl.

TRIPTERYGION BRACHYLEPIS, new species

FIGURE 113

Holotype.—USNM 142253 Bikini Atoll, lagoon at eastern end, coral head at depth of 20 to 25 feet, March 26, S–46–42, Brock and Schultz, 1 specimen, 25.5 mm., female.

Description.—The following measurements, made on the holotype, are expressed in thousandths of the standard length, which is 25.5 mm.: Length of head 333; greatest depth 180; least depth of caudal peduncle 71; length of snout 82; diameter of eye 110; tip of snout to rear edge of maxillary 133; bony interorbital space 27; postorbital length of head 157; snout tip to dorsal origin 243, to anus 474, to pelvic insertion 259; longest ray of first dorsal 137, second dorsal 137, third dorsal 157, pectoral 325, pelvics 251, anal 145, caudal 235.

The following counts were made: Dorsal IV–XIV–9; anal II, 19; pectoral iii,6,vi; pelvics I,2–I,2; branched caudal rays 5+4; pores in lateral lines 14+22, and vertical scale rows 36; scales in a zigzag row around caudal peduncle 8; orbital tentacles 1 on each eye; 2 scales between lateral line and base of second dorsal, and 3 scales between posterior lateral line and front of base of anal fin. Head 2.9; depth 5.5; longest pectoral ray (tenth from dorsal edge) 2.9; snout tip to anus 2.3; all in standard length. Snout 4.1; eye 3.1; postorbital length of head 2.1; least depth of caudal peduncle 4.5; greatest depth 1.9; all in length of head. Bony interorbital space 3.5 in eye.

Body scaled; scales on head behind orbits, on preopercle, opercle, base of pectoral, and on breast in front of anus; no scales on median fins except a few at base of caudal; two lateral lines, upper one 2 scale rows below base of spiny dorsals and ending opposite bases of fourth or fifth from last dorsal spines; posterior lateral line begins in second scale row below rear end of anterodorsal lateral line and continues as notched scales along midlengthwise axis of body; gill membranes free from isthmus, broadly connecting across isthmus; three separate dorsal fins; inner ray of pelvics longest; first unbranched and enlarged lower pectoral ray longest, notably reaching nearly to rear base of second dorsal; last dorsal and last anal rays membranously free from caudal peduncle; vertical line through first dorsal origin passes through base of pelvics; vertical line through anal origin passes through base of eighth spine of second dorsal; maxillary reaches a little past a vertical line through front of pupil; snout somewhat pointed as viewed from the side but rounded as viewed from dorsal side; small teeth in a band on both jaws, with outer row a little enlarged; vomer with a Λ-shaped narrow band of villiform teeth and some on palatines.

Color in alcohol.—Six brownish bars on upper side, becoming irregularly doubled on lower sides and continuing on anal fin as 9 narrow transverse bars; about 4 faint dusky bars on caudal fin; base of first dorsal dusky, tips dusky, but middle white; second spiny dorsal with a few transverse brown bars; soft dorsal with 4 brownish transverse bars; pectoral damaged, but probably with light dusky bars; pectoral base dusky; 1 dark bar below eye and 2 others extending forward from eye on snout; the broad-based and short orbital tentacle on each eye dark brown.

Ecology.—The only specimen of this species came from a coral head at a depth of 20 to 25 feet in Bikini lagoon.

Remarks.—After considerable hesitation and reluctance, because of the confusion occasioned by the number of species referred to *Tripterygion,* it was found necessary to add yet another species to this inadequately defined group.

T. brachylepis, new species, with IV spines in first dorsal, with scales on head and on base of pectoral, differs from the following species of *Tripterygion,* which have III spines in first dorsal and naked head and no scales on the breast: *annulatum* Ramsay and Ogilby 1887; *atriceps* Jenkins 1903; *atrogulare* Günther 1873; *callionymi* Weber 1909 and 1913; *clarkei* Morton 1888; *cerasinus* Jordan and Seale 1906; *ellioti* Herre 1944; *etheostoma* Jordan and Snyder 1902 (partly scaled breast); *fasciatum* Weber 1909 and 1913; *hemimelas* Kner and Steindachner 1866; *minutus* Günther 1876; *pardochir* Jordan and Seale 1906; *punctatus* Herre 1935; *pusillus* Rüppell 1835; *segmentatum* McCulloch and Phillipps 1923; *sexmaculatus* Fowler 1941; *tusitalae* Jordan and Seale 1906; *tutuilae* Jordan and Seale 1906; *waigiensis* Herre 1935. Slastenenko (Compte Rend. Acad. Sci. U. R. S. S. vol. 4, No. 3, pp. 153–156, 1936) refers the following species, which are also *Tripterygion,* to the synonymy of *tripteronotus* Risso 1810: *nasus* Risso 1826; *melanurus* Guichenot 1850; *melanocephalum* Cocco 1829; *nikolskii* Maximov 1909.

The following species of *Tripterygion* have III spines in first dorsal (but nothing is said about scales on head, breast or pectoral base, and it is assumed there were none): *obtusirostre* Klunzinger 1871; *striaticeps* Ramsay and Ogilby 1888.

The following species of *Trypterygion* with III spines in first dorsal, have scaly breasts but no scales on head or pectoral fin base: *bapturum* Jordan and Snyder 1902; *bucephalus* McCulloch and Waite 1918; and *etheostoma* Jordan and Snyder 1902 (breast only partly scaled). *Tripterygion macleayanum* Lucas 1891 has III spines in first dorsal and a scaly head, but no mention is made of scales on breast or pectoral base. *Gillias jordani* Evermann and Marsh 1899=*Enneapterygius pectoralis* Fowler 1941; and *Enneapterygius corallicola* Kendall and Radcliffe, has scales on head, breast, and pectoral fin bases but only III spines in the first dorsal fin.

This leaves but two species normally with IV spines in the first dorsal fin. Both of these, from New Zealand, *T. bucknilli* Griffin 1926 and *T. segmentatum* McCulloch and Phillipps 1923, have naked heads, breast and pectoral fin bases. Thus we are unable to find any named species referable to this genus with IV spines in first dorsal, scaly head, breast and pectoral fin base.

The species closest to *T. brachylepis* are *corallicola, jordani,* and probably *macleayanum;* but *jordani* has only 6 or 7 soft dorsal rays, *corallicola* has 13 or 14, and *macleayanum* has 12, whereas *brachylepis* has 9.

Named *brachylepis* in reference to the scales on pectoral fin base.

Genus HELCOGRAMMA McCulloch and Waite

Helcogramma McCulloch and Waite, Rec. South Australian Mus., vol. 1, p. 51, 1918 (type species, *Helcogramma decurrens* McCulloch and Waite).

Axoclinus Fowler, Acad. Nat. Sci. Philadelphia, Monogr. 6, p. 288, 1941 (type species, *Axoclinus lucillae* Fowler=*storeyae* Brock=*Enneanectes carminale* Jordan and Gilbert, of which the holotype, USNM 120946, was found by Schultz with the types of *Gobiesox zebra* and not lost as stated by Fowler (1941) and by Brock (Stanford Ichthy. Bull., vol. 2, No. 1, 1940); genus misspelled as typographical error by Fowler on p. 388, fig. 242, *Axochnus*).

The genus *Helcogramma* has been revised by Richard H. Rosenblatt[97] as part of his study of the family Tripterygiidae. Two species of this family occur in the Marshall Islands, and inasmuch as he does not contemplate publication of the full generic revision for some time, he has very kindly contributed for publication here his descriptions, with key, of these forms, which are new.

Helcogramma, in the sense used here, is restricted to those tripterygiid species possessing an axial lateral line composed of pored and unpored scales, one anal spine, palatine teeth, and two pelvic rays connected by a membrane for a part of their length.

KEY TO THE SPECIES OF HELCOGRAMMA OF THE NORTHERN MARSHALL ISLANDS

1*a*. Scalation much reduced, 0 (rarely 1) scales between lateral line and third spine of second dorsal, and 1 (rarely 0 or 2) scale between lateral line and fifth anal soft ray; maxillary short, ending at or before midpoint of eye (.098–.122 of standard length); eye small, .070–.092 of standard length; head short, .252–.301 of standard length; dark area on head of mature males restricted to lower parts, not extending above lower margin of eye ------------------ **Helcogramma chica**, new species

1*b*. Scalation less reduced, 3 (occasionally 2 or 4) scales between lateral line and third ray of second dorsal, and 2 or 3 scales between lateral line and fifth anal soft ray; maxillary longer, ending behind midpoint of eye (.145–.181 of standard length); eye larger, .090–.106 of standard length; head longer, .308–.340 of standard length; dark pigment on head of mature males not restricted to lower parts.
Helcogramma capidata, new species

HELCOGRAMMA CHICA Rosenblatt, new species

Figure 114

Enneapterygius hudsoni (not of Jordan and Seale), Schultz, U. S. Nat. Mus. Bull. 180, 1943, p. 286 (in part).

Holotype.—USNM 115516, Phoenix Islands, Hull Island, Ocean Reef, July 12–15, 1939, L. P. Schultz, male, 20.9 mm. standard length.

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[97] University of California at Los Angeles.

Paratypes.—USNM 175256, same locality and bearing the same data as the holotype, 21 specimens, 11.5 to 20.0 mm. standard length; USNM 115514, Phoenix Islands, Enderbery Island Reef, May 15–19, 1939, L. P. Schultz, 19 specimens, 12.0 to 21.0 mm. standard length; USNM 115515, Phoenix Islands, Hull Island, July 7–17, 1939, L. P. Schultz, 5 specimens, 13.5 to 18.5 mm. standard length; USNM 142252, Bikini Atoll, northeast corner of Namu Island, April 4, 1946, L. P. Schultz, 1 specimen, 21.4 mm. standard length; SNHM 52016, Caroline Islands, Kapingamarangi Atoll, outer reef flat, surge channels and surf zone at extreme west end of atoll, July 14, 1954, R. R. Harry, 10 specimens, 16.6 to 21.0 mm. standard length; SNHM 52015, Caroline Islands, Kapingamarangi Atoll, surf zone and outer corraliferous terrace at Tapatuaitu, July 21, 1957, R. R. Harry, 8 specimens, 13.5 to 19.9 mm. standard length.

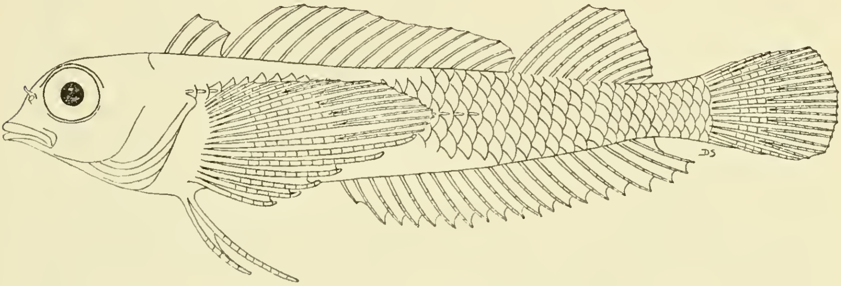

FIGURE 114.—*Helcogramma chica*, new species, holotype, male, USNM 115516, drawn by Dorothea B. Schultz.

Additional material studied.—USNM 115517, Samoa, Tutuila Island, reef at Alofau, June 3, 1939, L. P. Schultz, 1 specimen, 10.6 mm. standard length; USNM 115513, Samoa, Rose Island, June 11–14, L. P. Schultz, 1 specimen, 14.1 mm. standard length; George Vanderbilt Foundation High Island Atoll Project, Station 112, Palau Island, about 2 miles south-southwest of Urukthapel Island, Aug. 19, 1955, Harry, Fehlman, and Pierce, 1 specimen, 17.5 mm. standard length.

Description.—Based on the material listed above. Mean values are recorded, followed by data in parentheses giving the range for the entire sample. A sample of 32–34 was utilized for the counts, and one of 15–18 for all measurements except the length of the third dorsal soft ray, where the sample size was 10. Measurements are expressed as thousandths of the standard length. Counts and measurements on the holotype are tabulated on p. 298.

Dorsal rays III–XV–9.8 (III–XIV to XVI–9 to 10); anal rays I,19.3 (I,18 to 20); pectoral rays 16.0 (15–17); 21.4 pored plus 18 unpored scales in lateral line (20–23 plus 17–19); total lateral line scales 39.4 (38–41); scales between lateral line and third spine of second dorsal .26 (0–1); scales between lateral line and fifth anal soft ray 1 (0–2); head length 280 (252–301); postorbital length of head 136 (127–145); depth of head between occiput and isthmus 174 (162–200); greatest width of head 185 (171–194); snout length 97 (91–103); length of maxilla 108 (98–122); eye diameter 81 (70–92); length of second dorsal base 365 (343–397); length of third dorsal base 185 (171–211); length of anal base 439 (418–459); distance from pelvic origin to base of anal spine 289 (259–321); length of caudal peduncle 138 (120–155); least depth of caudal peduncle 79 (70–83); length of first dorsal spine 84 (70–91); length of second dorsal spine 83 (75–96); length of third dorsal spine 74 (57–86); length of third spine of second dorsal 138 (126–151); length of third ray of third dorsal 125 (114–145).

Mouth narrow, muzzle protruding, giving head a pointed appearance; outline of snout abruptly descending before eyes, profile of snout slightly convex to almost vertical; anterior nostril with a short tube which bears a lobate tentacle, posterior nostril with a raised rim; no orbital tentacle; mouth small, maxillary ending at or before midpoint of eye; chin with a median pit just behind mandibular symphysis; head bones smooth, except for a feeble development of spination along the path of the mucous canals of the frontals and the superficial bones enclosing the supratemporal canal of the lateral line system; teeth in both jaws conical, slightly recurved, arranged in bands, outermost teeth of upper jaw somewhat enlarged; vomer with a V-shaped patch of teeth; a small patch of teeth at head of palatine; soft rays of dorsal and anal simple, except for the ultimate ray, which is branched to the base; principal caudal rays branched; pectoral formula typically ii,7,vii or i,8,vii, first unbranched ray longest, lower 7 pectoral rays thickened; pelvic rays two, inner ray the longer; pelvic rays bound together by a membrane for about ⅔ the length of the outer ray and somewhat more than ⅓ the length of the inner ray; first dorsal spines not graduated, third spine the shortest; outline of second dorsal even, first spine almost as high as longest (third or fourth), spines subsequent to the fourth or fifth gradually decreasing in height; third dorsal soft ray longest; anal spine about ½ as long as first anal ray; scales ctenoid, scalation much reduced; no scales on head, nape, belly or pectoral base; upper sides with at most one row of scales above lateral line back to level of middle of second dorsal base, scalation becoming more complete back of this point; upper sides seldom completely scaled at any point before end of third dorsal; lower sides never completely scaled, lower surface of caudal peduncle naked.

Sexes alike in body and fin proportions, differing only in color; male with a small conical urogenital papilla, female with a broader, rugose urogenital papilla; size at maturity small, largest adult 21.4 mm. standard length, smallest mature specimen 15.1 mm. standard length.

Color in alcohol.—Males with body ground color translucent pink, throat and lower parts of head dark brown to black, this coloration restricted to the portion of the head below the level of the lower margin of the orbit; the dark coloration of the head is continued onto the pectoral base as a dark triangle, the apex of which encroaches on a few of the middle pectoral rays; and all unpaired fins clear. Females and juvenile males with entire body a clear pink, no dark pigment present.

Remarks.—*Helcogramma chica* is in many respects quite similar to *Helcogramma fuscipectoris* (Fowler) (=*Enneapterygius fuscipectoris* Fowler, Proc. Acad. Nat. Sci. Philadelphia, vol. 98, 1946, p. 186, fig. 50–51). *Enneapterygius personatus* Fowler (*ibid.* p. 185, fig. 48–49) is here regarded as a synonym of *Helcogramma fuscipectoris* (Fowler). I have examined the holotypes of both of Fowler's species, and have the paratypes before me. *H. chica* agrees remarkably well with *H. fuscipectoris* in body proportions, fin ray formula, and certain details of coloration. It differs from that species, however, in several important respects: *H. fuscipectoris* has a well developed orbital tentacle, the unpaired fins and the sides are dusted with melanophores which tend to be arranged in faint bars, and there are three scales between the lateral line and the third spine of the second dorsal. *Helcogramma chica* is distinguished from its Marshall Island congener, *H. capidata* in the discussion of that species.

The trivial name of this form, which is taken from the Spanish adjective meaning little, refers to the small size at maturity.

HELCOGRAMMA CAPIDATA Rosenblatt, new species

PLATE 121,C

Enneapterygius hudsoni (not of Jordan and Seale), SCHULTZ, U. S. Nat. Mus. Bull. 180, 1943, p. 286 (in part).

Helcogramma sp., RANDALL, Atoll Res. Bull. No. 47, p. 216, 1954.

Holotype.—SNHM 52010, Caroline Islands, Kapingamarangi Atoll, Prosipai region of Saratokmalel reef flat in Teawaiua Ship Pass, Aug. 14, 1954, R. R. Harry, male, 33.1 mm. standard length.

Paratypes.—SNHM 52011, same locality and bearing the same data as the holotype, 1 specimen, 29.8 mm. standard length; SNHM 52013, Caroline Islands, Kapingamarangi Atoll, lagoon reefs bordering outer reef flat at Tiutua, midway between Ship Pass and west end of atoll, July 13, 1954, R. R. Harry, 21 specimens, 18.0 to 30.5 mm. standard length; SNHM 52012, Caroline Islands, Kapingamarangi Atoll, Polim reef flat region next to Tipongowakaram Pass in Ship Pass, Aug. 12, 1954, R. R. Harry, 4 specimens, 17–25 mm. standard length; SNHM 52014, Caroline Islands, Ifaluk Atoll, outer reef edge at surf line on south side of Falalap Islet, Oct. 22, 1953, R. R. Harry, 7 specimens, 26.0–31.1 mm. standard length; USNM 175255, Phoenix Islands, Hull Island, ocean reef, July 12–15, 1939, L. P. Schultz, 2 specimens, 22.5–25.8, mm. standard length; USNM 142249, Rongelap Atoll, Rongelap Island, near north end, July 25, 1946, Brock, Herald and Kohler, 1 specimen, 27.5 mm. standard length; USNM 142250, Rongerik Atoll, Bock Island, June 27, 1946, Schultz and Herald, 2 specimens, 22.5–25.8 mm. standard length.

Additional material examined.—George Vanderbilt Foundation Caroline Islands Expedition, Kapingamarangi Atoll, Station 143, Tihatukira region of Saratokamungeia reef flat in middle of Ship Pass, Aug. 13, 1954, 1 specimen, 29.3 mm. standard length; George Vanderbilt Foundation High Island—Atoll Project, Palau Islands, Station 25, lagoon edge of Barrier reef 8 miles northwest of Koror Island, July 19, 1955, 4 specimens, 24.0–30.4 mm. standard length; George Vanderbilt Foundation High Island—Atoll Project, Palau Islands, Station 232, Barrier reef 8 miles northwest of Koror Island, Oct. 16, 1955, 3 specimens, 25.9–28.5 mm. standard length.

Tabulated below are counts and measurements in millimeters made on the holotypes of the two species of *Helcogramma.* Figures in parentheses are the resulting proportions, expressed as thousandths of the standard length.

Characters	*H. chica* (USNM 115516)	*H. capidata* (SNHM 52010)
Standard length	20.9	33.1
Head length	6.2 (297)	10.7 (334)
Postorbital length of head	2.5 (139)	4.5 (136)
Head width	4.0 (191)	6.9 (208)
Head depth at occiput	3.5 (168)	6.4 (193)
Maxillary length	2.5 (120)	6.0 (181)
Snout length	2.0 (96)	3.8 (115)
Eye diameter	1.8 (86)	3.2 (97)
Length of second dorsal base	7.9 (380)	10.6 (320)
Length of third dorsal base	4.4 (211)	6.3 (190)
Length of anal base	9.6 (459)	14.9 (450)
Pelvic origin to anal origin	5.7 (273)	8.0 (242)
Caudal peduncle length	2.5 (120)	3.9 (118)
Caudal peduncle depth	1.6 (77)	2.6 (78)
Length of fin rays:		
First dorsal spine	1.9 (91)	4.4 (133)
Second dorsal spine	2.0 (96)	3.7 (112)
Third dorsal spine	1.5 (72)	3.0 (91)
Third spine of second dorsal	3.0 (144)	5.5 (166)
Third ray of third dorsal	2.5 (120)	4.6 (139)
Longest pectoral ray	6.2 (297)	9.5 (287)
Longest pelvic ray	4.9 (234)	7.0 (211)

Characters	*H. chica* (USNM 115516)	*H. capidata* (SNHM 52010)
Counts:		
Dorsal	III–XIV–10	III–XIV–11
Anal	I,19	I,21
Pectoral (left)	16	16
Lateral line scales	22+17	23+17
Scales between third spine of second dorsal and lateral line	1	4
Scales between fifth anal soft ray and lateral line	1	3

Description.—Based on the material listed above. Mean values are recorded, followed by data in parentheses giving the range for the entire sample. A sample of 27–28 was utilized for the counts, and one of 13–17 for the measurements. Measurements are expressed as thousandths of the standard length. Counts and measurements on the holotype are tabulated above.

Dorsal rays III–XIV–10.8 (III–XIII to XIV–10 to 12); anal rays I,20.8 (I,20–21); pectoral rays 15.7 (15–16); 22.6 pored plus 16.8 unpored scales in lateral line (21–25 plus 15–18); total lateral line scales 39.4 (38–40); scales between lateral line and third spine of second dorsal 3 (2–4); scales between fifth anal soft ray and lateral line 2.8 (2–3); head length 326 (308–340); postorbital length of head 147 (125–149); depth of head between occiput and isthmus 185 (177–196); greatest width of head 207 (193–216); snout length 102 (92–115); length of maxilla 160 (145–181); eye diameter 99 (90–106); length of second dorsal base 313 (269–336); length of third dorsal base 151 (139–164); length of anal base 417 (392–450); distance from pelvic origin to base of anal spine 292 (242–334); length of caudal peduncle 126 (117–141); least depth caudal peduncle 76 (70–84); length of first dorsal spine 124 (104–142); length of second dorsal spine 106 (88–119); length of third dorsal spine 84 (73–91); length of third spine of second dorsal 157 (137–170); length of third ray of third dorsal 157 (141–164).

Mouth wide, lips thick, front of head blunt; outline of snout gradually descending, profile of snout slightly concave before eyes; anterior nostril with a short tube which bears a lobate tentacle, posterior nostril with a raised rim; no orbital tentacle; maxillary ending behind midpoint of eye; chin with a median pit just behind mandibular symphysis; head bones smooth except for a feeble development of spination along the path of the mucous canals of the frontals and the superficial bones enclosing the supratemporal canal of the lateral line system; teeth in both jaws conical, recurved, arranged in bands, outermost teeth of upper jaw largest; vomer with a V-shaped patch of teeth; a small patch of teeth at head of palatine; soft rays of dorsal and anal simple except for the ultimate ray, which is branched to the base;

principal caudal rays branched; pectoral formula variable, typically iii,6,vii, but often ii,7,vii or iv,5,vii; first unbranched pectoral ray longest, lower 7 thickened; pelvic rays two, inner ray the longer; pelvic rays bound together by a membrane for approximately ⅔ the length of the outer ray and somewhat more than ⅓ the length of the inner ray; spines of first dorsal graduated, lower than second dorsal; outline of second dorsal even, first spine almost as high as longest (third or fourth), rays subsequent to fifth gradually decreasing in height; third dorsal soft ray longest; anal spine slightly less than ½ as long as first anal ray; scales ctenoid, scalation reduced, no scales on head, nape, belly or pectoral base; a wide naked band under first and second dorsals, narrowing gradually, so that upper sides are completely scaled only back of the second dorsal; a naked band above anal continuing the length of the fin, but ending at last ray of anal, so that lower surface of caudal peduncle is scaled.

Some sexual dimorphism of body proportions is present in this species. The dorsal fins of males are, on the average, slightly higher than those of females. More important, however, is the dimorphism in the length of the belly and the anal base. The distance between the pelvic and anal origins is greater in females (average for 9 females 312, average for 12 males 280), while the anal base is shorter (average for 9 females 405, average for 11 males 426). The number of anal rays appears to be the same in both sexes.

On the basis of the material available to me, the maximum size attained by this species is about 31 mm. The smallest mature male in my material is 25.5 mm. standard length, and the smallest mature female 25.0 mm. All specimens below this size are clearly immature.

Color in alcohol.—Male with body a clear translucent pink with only a few scattered melanophores, mostly below the lateral line on the anterior part of the sides. Pectoral base dark, pigment most concentrated on lower ⅔ of pectoral base, forming a triangular black spot which encroaches on the pectoral rays. Sides and lower surface of head dark, as is the throat back to the pectoral base. Interorbital and top of head pink with a few scattered melanophores. Pelvic rays dark for about ⅔ the length of the inner ray. Margins of dorsal fins dark, anal dusky, this coloration more intense at the margin. Caudal clear. Female and juvenile male with body pink; head, breast and pectoral base with a few scattered melanophores; fins clear, or with a few scattered dusky spots.

Remarks.—In addition to the characters mentioned in the key, *H. capidata* differs from *H. chica* in size at sexual maturity and maximum size, coloration of vertical fins, number of rays in second and third dorsals, number of anal rays, and number of pored scales in lateral line.

The name refers to the hooded appearance of the dark-headed males.

Family BLENNIIDAE: Scaleless Blennies

Dr. Wilbert M. Chapman during 1947 turned over to me copies of his manuscript on the Blenniidae, along with 62 original drawings of the salariine blennies. He gave me permission to use his studies and data in this report and as a result I have placed Dr. Chapman as co-author of the subfamily Salariinae. Observations and notes made on type specimens by Dr. Chapman in European and American museums greatly aided the early completion of my study of the Salariinae.

Photographic copies were made of the original illustrations loaned to me and these are on file in the U.S. National Museum. The originals were returned, as he hopes to complete his studies.

Dr. Chapman and I define the tropical blennies, family Blenniidae, as follows: Scaleless; elongate fishes; teeth in jaws usually in a single, crowded series; often with a posterior canine in lower jaw; canines occur in postlarvae and juveniles at symphysis of jaws (they are lost at transformation); vomerine teeth absent, except present in *Entomacrodus;* palatine teeth lacking; dorsal fin long, consisting of flexible spines and articulated rays, the spinous and soft rayed parts usually of nearly equal extent and separated by a notch or indentation; caudal fin free or fused with dorsal and anal fins; anal fin long, with or without a few flexible spines anteriorly, and articulated soft rays posteriorly, the two portions not separated by an indentation; all dorsal and anal rays may be flexible spines or articulated rays; pectorals present, pelvics jugular in position (inserted anterior to base of pectorals), with a hidden spine and 2 to 4 soft rays; gill membranes free or restricted, sometimes gill opening restricted to sides; cirri present or absent on head.

The correct identification of the salariine blennies requires very careful and detailed observations of specimens under proper magnification. In order to comprehend certain difficult characters and to understand the importance of them, one should have an extensive blenny collection at hand for comparative purposes. This complicated group is so widely distributed that identifications made on the basis of a limited faunal area are unsatisfactory.

Norman (Ann. Mag. Nat. Hist., ser. 11, vol. 10, p. 794, 1943) defined the two subfamilies under the family Blenniidae as follows:

1a. Premaxillary with a marked bony crest, forming a groove for the reception of the upper lip, the pedicel usually feeble; teeth, except in *Rhabdoblennius*, very small, implanted in the skin of the lips, and freely movable Salariinae (p. 302)

1b. Premaxillary without a bony crest above the upper lip, the pedicel usually strong; teeth large or of moderate size, more or less firmly attached to the bone and usually immovable_______________Blenniinae (p. 373)

Subfamily SALARIINAE

By LEONARD P. SCHULTZ and WILBERT M. CHAPMAN

This complicated and wide-ranging group of tropical scaleless blennies is well represented in the Northern Marshall and Marianas Islands, where most of the species are abundant in the shallow waters of the reefs.

In this subfamily, the length of the head is measured from the tip of the snout or front of the upper lip to the rearmost part of the gill cover; sometimes, especially in *Ecsenius*, the upper lip is not as far forward as the forehead. Unless ample magnification is used, when counting the dorsal spines, the last one may be overlooked, because it is very small and sometimes somewhat embedded. The anal spines of the males are usually distinct; the first anal spine on females is minute and may be and usually is completely embedded, whereas the second usually is evident. Each fin ray with a separate base is counted as one ray.

The dentition of the jaws consists of very numerous small "scraping" teeth that are movable, except in *Rhabdoblennius* and in the lower jaw of *Ecsenius*. On each side of the lower jaw and well back from the front, in many species, occurs a strong, curved, conical, posterior canine, which is sometimes small or absent.

Probably most of the salariian blennies pass through a postlarval pelagic state known as *Ophioblennius*, which Norman (Ann. Mag. Nat. Hist., Ser. 11, vol. 10, p. 794, 1943) included in the subfamily Ophioblenniinae. The lower jaw of these pelagic forms has about 2 pairs of canine teeth that point or are hooked outward. Reid (Journ. Washington Acad. Sci., vol. 33, No. 12, pp. 373–384, 1943) reviewed the genera related to *Ophioblennius*, and we have been able to assign some of these "Ophioblennius" stages to the adult of the currently recognized species; thus the subfamily Ophioblenniinae represents a postlarval stage of other scaleless blennies.

KEY TO SOME GENERA OF THE SUBFAMILY SALARIINAE

1*a*. A fringe of 20 to 60 cirri in a transverse row across nape.
  2*a*. A pair of barbels on underside of throat, each side of middle of chin; teeth in upper jaw very numerous, fine, flexible, those in lower jaw numerous, moderately flexible, about twice as broad as those in upper jaw and about one-third as many; no canines; least distance between eye and nuchal fringe contained 2½ or more times in postorbital length of head; soft dorsal rays 12 or 13, anal 14 or 15; upper lip with short barbels________________Exallias Jordan and Evermann

2*b*. No barbels on underside of head; teeth in both jaws very numerous, fine, flexible, and of approximately the same size; one or two canines present each side of lower jaw; least distance between eye and nuchal fringe contained fewer than 2 times in postorbital length of head; soft dorsal rays 14 to 16, anal 15 to 17; upper lip crenulate or nearly so.
Cirripectes Swainson

1*b*. No transverse fringe of cirri across nape.

3*a*. Teeth in lower jaw, excepting any canines that might be present, firm and mostly fixed in position (i. e., not freely movable); pelvics I,2 or I,3; last dorsal and anal rays membranously attached to caudal peduncle; no teeth on vomer, except sometimes 2 or 3 on *Rhabdoblennius*; lateral line incomplete, ending under spiny dorsal fin; edges of both lips smooth.

4*a*. Teeth in upper jaw 40 to 50, fixed or firm, not freely movable but similar to those in lower jaw, also numbering 40 to 50; branched caudal fin rays normally 5+4, except in young; nuchal, orbital, and nasal cirri, if present, always simple; pectoral rays normally 14; angle of snout profile from vertical to a backward slant of about 5 degrees
Rhabdoblennius Whitley

4*b*. Teeth in upper jaw freely movable; no caudal fin rays branched, even in adults; nuchal and orbital cirri always absent; nasal cirrus always present, simple; pectoral rays normally 13 to 15; angle of snout profile with a notable backward slant of from 15 to 45 degrees.
Ecsenius McCulloch

3*b*. Teeth in both jaws very numerous, freely movable.

5*a*. Vomer with a row of minute conical, blunt teeth across it (these are difficult to observe without adequate magnification); pelvics I,4 (last soft ray usually difficult to observe without adequate magnification); branched caudal fin rays normally 5+4, except in young; orbital and nasal cirri present, usually with multifid cirri on edges; nuchal cirrus present or absent, if present, always small and simple; pectoral rays normally 14; lateral line arched over pectoral then descending about opposite tip of pectoral fin to midlengthwise axis and usually ending opposite middle third of anal base or continuing to caudal base as a series of isolated pores; angle of snout profile from nearly vertical to a forward slant of up to about 15 degrees; dorsal rays XIII,13 to 18, anal II,14 to 18.
Entomacrodus Gill

5*b*. No teeth on vomer.

6*a*. A prominent cup-shaped sucking disk or appendage behind lower lip; pelvics I,4; none of caudal fin rays branched; no nuchal cirrus; orbital tentacle with cirri; nasal cirrus simple; pectoral rays 15; last anal ray membranously attached to caudal peduncle, last dorsal ray free from caudal peduncle; lateral line absent; both lips with crenulate edges; dorsal rays XIV to XVII,17 to 21; anal II,23 to 25. (Philippines; Indo-Australian Archipelago; Andamans; Christmas Island of Indian Ocean.)
Andamia[98] Blyth

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[98] *Andamia* Blyth, Journ. Asiatic Soc. Bengal, vol. 27, p. 270, 1858 (type species, *Andamia expansa* Blyth = *Salarias heteropterus* Bleeker).

6*b*. No sucking appendage behind lower lip.

7*a*. Pelvics I,2 or 3; lateral line incomplete.

8*a*. Dorsal fin without notch or emargination over last dorsal spine; last dorsal spine about same length as next to last; no minute spine just in front of first soft dorsal ray; last anal ray wholly or partly membranously attached to caudal peduncle; last dorsal ray membranously attached as far posteriorly as base of upper caudal fin rays.

9*a*. Pectoral rays normally 15 or 16 without lower rays enlarged or swollen; dorsal rays X,20 or 21; anal about II,19; middle caudal fin rays elongate and no caudal ray branched; orbital, nuchal, and nasal cirri, single and simple; upper lip with little lappetts as long as wide. (East Indies and Philippines to Red Sea.)------**Atrosalarias**[99] Whitley

9*b*. Pectoral rays normally 14 or 15; lower rays somewhat swollen, dorsal rays about XII,18 to 20, anal about II,17 to 19; middle caudal rays not notably elongate; branched caudal rays 5+4, except in young; orbital tentacle simple or with cirri on edges; nuchal tentacle broad based, palmate, with cirri distally; nasal cirri multifid; upper lip smooth edged. **Salarias** Cuvier

8*b*. Dorsal fin with a deep notch or notable emargination over last dorsal spine; last dorsal spine short or minute, notably much shorter than first soft dorsal ray; dorsal spines XII to XV,15 to 23; anal II,16 to 24; pectoral rays normally 14 and lower 4 or 5 rays swollen; caudal fin truncate to rounded with branched rays 5+4 except in young; orbital tentacle simple or multifid; nuchal cirrus present or absent, variable; nasal cirri multifid; upper lip crenulate or smooth edged, but no lappetts.

10*a*. Last anal ray without membranous attachment to caudal peduncle; anal ray of male notably elongate. **Istiblennius** Whitley

10*b*. Last anal ray wholly or partly membranously attached to caudal peduncle; first soft anal rays of male much longer than others; orbital, nuchal, and nasal cirri simple, single. **Negoscartes**[1] Whitley

7*b*. Pelvics I,4, the inner ray small but evident under magnification; last anal ray membranously free from caudal peduncle.

11*a*. Dorsal rays XII,10 or 11; anal II,11 or 12; caudal fin normally with 5+4 branched rays except in immature; nuchal cirrus simple, single on each side; no orbital cirrus; nasal cirrus simple; pectoral rays normally 15; lateral line with a few pores over pectoral fin; edges of both lips smooth; angle of snout profile from nearly vertical to a forward slant of as much as 30 degrees----------**Fallacirripectes**, new genus

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[99] *Atrosalarias* Whitley, Rec. Australian Mus., vol. 19, p. 93, 1933 (type species, *Salarias phaiosoma* Bleeker=*S. fuscus* Rüppell).

[1] *Negoscartes* Whitley, Mem. Queensland Mus., vol. 10, p. 20, 1930 (type species, *Salarias guttatus* Cuvier and Valenciennes).

Crenalticus Whitley, Mem. Queensland Mus., vol. 10, No. 1, pp. 20–21, 1930 (type species, *Salarias crenulatus pallidus* Whitley).

11*b*. Dorsal rays XII,17 to 23; anal II,19 to 27; orbital tentacle usually with cirri on its edges or basally.

12*a*. Pectoral rays normally 14; caudal fin normally with 5+4 branched rays, except in young; last dorsal fin ray membranously attached to caudal peduncle; nasal flap multicirrate; nuchal cirri in 1 or 2 patches, or a broad-based palmatelike cirrus; lateral line complete; edge of upper lip with distinct papillaelike lappetts that are as long as broad; lower lip smooth edged; snout profile with a forward slant of from 20 to 30 degrees; dorsal rays about XII,17 or 18 and anal II,18 or 19; dorsal fin notched.
Scartichthys[2] Jordan and Evermann

12*b*. Pectoral rays normally 15; none of the caudal fin rays are branched even in adults; last dorsal fin ray membranously free from caudal peduncle; lateral line incomplete; snout profile rounded, with a slight forward slant.

13*a*. Lateral line represented by about 1 to 3 pores; dorsal rays XIV,21 to 23; anal II,24 to 27; edges of both lips crenulate______________**Alticus** Cuvier and Valenciennes

13*b*. Lateral line ending under middle of length of dorsal fin base; dorsal rays XIII,17 to 21; anal II,19 to 21; edges of both lips smooth or crenulate.
Praealticus, new genus

Genus EXALLIAS Jordan and Evermann

Exallias JORDAN and EVERMANN, Bull. U. S. Fish Comm., vol. 23 (1903), p. 503, 1905 (type species, *Salarias brevis* Kner).

Gloriella SCHULTZ, Copeia, No. 1, p. 17, 1941 (type species, *Cirripectes caninus* Herre).

EXALLIAS BREVIS (Kner)

PLATE 113,A

Salarias brevis KNER, Sitzb. Akad. Wiss. Wien, vol. 58, p. 42, pl. 6, fig. 18, 1868 (type locality, Savaii, Samoa).—WEBER, *Siboga*-Expeditie, vol. 57, p. 537, 1913 (Karakelang Island).

Cirripectes brevis FOWLER, Mem. Bishop Mus., vol. 10, p. 432, 1928 (Hawaii; Marshall Islands).

Salarias leopardus DAY, Proc. Zool. Soc. London, p. 518, 1869 (type locality, Ceylon).

Blennius leopardus DAY, Fishes of India, vol. 2, p. 325, pl. 68, fig. 5, 1876 (Ceylon).

Cirripectes leopardus SCHULTZ, Copeia, No. 1, p. 19, 1941 (Oahu); U. S. Nat. Mus. Bull. 180 pp. 272–273, 1943, (Oahu and Rose Island).—CHAPMAN *in* de Beaufort and Chapman, Fishes of the Indo-Australian Archipelago, vol. 9, pp. 247–249, fig. 43, 1951 (Moluccas, Talaut, Marshalls, Hawaiian, and Samoan Islands).

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[2] *Scartes* Jordan and Evermann, Rep. U. S. Comm. Fish, vol. 21 (1895), p. 471, 1896 (preoccupied).
Scartichthys Jordan and Evermann, U. S. Nat. Mus. Bull. 47, pt. 3, p. 2395, 1898 (type species, *Salarias rubropunctatus* Cuvier and Valenciennes; replaces *Scartes*).—Cohen, Copeia, No. 4 (1956), pp. 246–248, 1957 (on synonymy of *Scartichthys gigas* Steindachner.

Cirripectes caninus Herre, Philippine Journ. Sci., vol. 59, No. 2, p. 284, 1936 (type locality, Ternate Island, Moluccas); and vol. 70, No. 4, p. 342, 1939 (Ternate Island).

Gloriella canina Schultz, Copeia No. 1, p. 18, 1941 (Ternate Island).

SPECIMENS STUDIED

Bikini Atoll: 8 stations, 12 specimens, 58 to 92 mm. in standard length.
Rongelap Atoll: 2 stations, 3 specimens, 65 to 71 mm.
Rongerik Atoll: 2 specimens, 27 to 28 mm.

Description.—Dorsal rays XII,12 or 13; usually 13; anal II,13 or 14, usually 14; pectoral 15 with lower 6 rays thickened; pelvics I,4; branched caudal rays 5+4; cirri in band across nape 30 to 36; nasal cirri 4 to 7, more cirri on larger specimens, orbital cirri 6 to 9. Head 2.6 to 2.9; greatest depth 2.6 to 2.7; longest dorsal spine 4.0 to 4.5; longest thickened pectoral ray 3.4 to 3.5; all in standard length. Eye 3.2 to 4.7; snout 2.2 to 2.5; interorbital space 6.0 to 8.0; postorbital length of head 1.7 to 2.0; least depth of body 2.7 to 3.1; greatest depth of body 0.9 to 1.1; preorbital width 4.6 to 4.8; all in length of head from tip of snout to rear of fleshy tip of gill cover.

Orbital tentacle flattish, with slender peduncle basally, its distal edge with 5 to 10 minute cirri; nuchal band of cirri, simple, those near middorsal line notably longer than lateral ones; nuchal band of cirri curving posterioventrally so that the distance between vertical lines through ventrolateral tip and anterodorsal edges is contained 3 to 3.5 times in postorbital length of head; ventral tip of nuchal band of cirri reaches to about opposite upper edge of eye, or not quite to it; snout profile nearly vertical; upper lip with 17 to 24 short papillae; lower lip plicate; a pair of cirri on pores on each side of midline just behind lower lip; lateral line arched over pectoral fin, then curving to meet lengthwise axis of body and ending at base of caudal fin; a vertical line through dorsal fin origin passes just behind lower tip of nuchal band of cirri and just in front of pelvic insertions; pectoral fin reaches a little past anal origin; anal spines (two) with swollen blackish and convoluted pads in adult males; first anal spine of female concealed in genital pad; no canines; teeth in both jaws very numerous, more in upper than in lower, movable; sixth pectoral ray from lowermost edge of fin longest; posteriorly caudal fin is a little rounded.

Color in alcohol.—Background pale or strawcolor; profusely covered with small black or dark brown spots, usually but not always arranged in groups of 4 to 10 spots more or less forming 5 or 6 double bars; all fins black spotted; in several specimens the black spots are evenly scattered and not arranged in groups or bars. The two smallest specimens recorded herein have the black spots larger and fewer in number, indicating an increase in number of black spots with increase in size; anal fin sometimes dusky; the two anal spines of adult males have an enlarged convoluted black dermal band distally; peritoneum blackish; black spots on pectoral and caudal usually forming transverse rows.

Color when alive.—Background color pale, tinged with yellowish; dorsal and caudal fins light yellowish; dark spots blackish, usually surrounded by brownish.

Ecology.—This rare species was found living mostly in the outer edge of the reefs where the surf was strong and a Lithothamnium "ridge" occurred.

Remarks.—The pelagic Ophioblennius stage is black spotted and is represented by *Cirripectes caninus* Herre.

Genus **CIRRIPECTES** Swainson

Cirripectes Swainson, Natural history and classification of fishes . . . , vol. 2, pp. 182, 275 (*Cirripectus* on pp. 79–80), 1839 (type species, *Salarias variolosus* Cuvier and Valenciennes).—Bleeker, Versl. Akad. Wet. Amsterdam, vol. 2, p. 278, 1868.—Weber, *Siboga*-Expeditie, vol. 57, p. 539, 1913.—McCulloch and McNeil, Rec. Australian Mus., vol. 12, pp. 21–23, 1918.—Schultz, Copeia No. 1, p. 18, 1941.

Cirripectus Norman, Ann. Mag. Nat. Hist., ser. 11, vol. 10, p. 810, 1943 (type species, *Salarias variolosus* Cuvier and Valenciennes).—Chapman, *in* de Beaufort and Chapman, Fishes of the Indo-Australian Archipelago, vol. 9, p. 246, 1951.—Strasburg and Schultz, Journ. Washington Acad. Sci. vol. 43, No. 4, p. 128, 1953.

The problem of the valid spelling of this genus has arisen perhaps as the result of Norman's use of the spelling "*Cirripectus*" in 1943. Previous to that date most authors spelled the genus *Cirripectes*.

The rules of zoological nomenclature adopted by the 14th International Congress of Zoology, Copenhagen, 1953, recommend in paragraph 71 (1aii) that, where more than one original spelling occurred, the spelling used by the "first subsequent user" should be the "valid original spelling." Under Article 28, paragraphs 123 and 124, the rule of the first reviser is reinstated and is rigidly construed (paragraph 124a), i. e., the first reviser must state that he is selecting one of the names to the exclusion of others, when two or more spellings occur for the same taxon.

Although both Schultz (1941) and Norman (1943) in a broad sense revised the genus, neither stated that they were selecting one spelling and excluding the other. Schultz used "*Cirripectes*" because the diagnosis actually appeared together with the description of the type species on page 275, and because that spelling had been used since 1868. Norman apparently used "*Cirripectus*" because it had page priority. In a still earlier revision of the genus McCulloch and McNeil (1918) selected the spelling "*Cirripectes*" and placed "*Cirripectus*" as a synonym.

If that does not fix the valid spelling then one must go back to the "first subsequent user"; this appears to be Bleeker (1868), who used the generic name as a subgenus when he described as new "*Salarias* (*Cirripectes*) *polyzona*." Bleeker (Versl. Akad. Wet. Amsterdam, vol. 7, p. 37, 1873) used this same name again.

Hence, the correct spelling is *Cirripectes* and not *Cirripectus*.

KEY TO SPECIES OF CIRRIPECTES FROM THE MARSHALL AND MARIANAS ISLANDS

(Modified after Strasburg and Schultz, Journ. Washington Acad. Sci., vol. 43, No. 4, pp. 129–130)

1*a*. Body and pectoral fins everywhere covered with dark spots on paler background; nuchal cirri 47 to 62; dorsal rays XII,14; anal II,15.
C. fuscoguttatus Strasburg and Schultz

1*b*. Body and pectoral fins not marked as in 1*a*; dark spots, if present, do not uniformly cover the body and pectoral fins; nuchal cirri 43 or fewer.

  2*a*. Anterior half of body pale, with darker spotting; posterior half of body blackish, with pale spotting; supraorbital cirrus slender and simple; dorsal rays XII,15; anal II,15 or 16 (rarely 15); length of snout 0.7 to 0.8 in least distance from eye to nuchal fringe; figure 115.
  C. jenningsi[3] Schultz

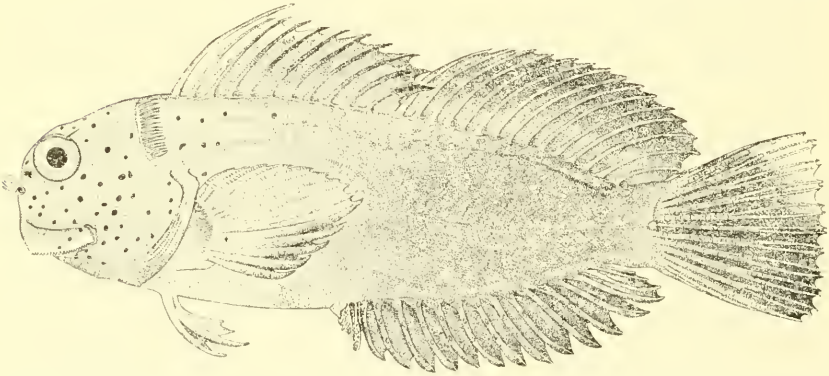

FIGURE 115.—*Cirripectes jenningsi* Schultz, holotype, USNM 115486, from Swains Island. Drawn by A. M. Awl.

  2*b*. Color pattern not as in 2*a*.

    3*a*. Color of head and body plain tan to dark brown, sometimes with scattered pale spots or dots on snout, cheeks, and upper lip; fins brown to blackish except sometimes anterodorsal part of spinous and soft dorsals and upper lobe of caudal fins pale or whitish.

      4*a*. Nuchal cirri totaling 24 to 30; dorsal rays XII (rarely XIII),14 or 15; anal II,15 or 16; first dorsal spine notably elongate in adults of both sexes (as short as 45 mm. in standard length).
      C. filamentosus[4] (Alleyne and Macleay)

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[3] *Cirripectes jenningsi* Schultz, U. S. Nat. Mus. Bull. 180, pp. 273–275, fig. 27, 1943 (type locality, Swains Island).

[4] *Salarias filamentosus* Alleyne and Macleay, Proc. Linnean Soc. New South Wales, vol. 1, p. 337, pl. 14 fig. 1, 1877 (type locality, Cape York).

4*b*. Nuchal cirri totaling 29 to 37; dorsal rays XII,14; anal II,14 or 15; first dorsal spine elongate only in adult males.
C. variolosus (Cuvier and Valenciennes)

3*b*. Head and body not colored as in 3*a*.

5*a*. Dorsal rays XII,13 or 14; anal II,14 or 15; background coloration light tan to dark brown; Young, lengthwise dark stripe from behind eye to caudal fin base, sometimes broken into series of elongate blotches; Adults with 5 to 12 vertical dark brown bars and throat, cheeks, and opercles usually with numerous roundish pale spots, the size of pupil, enclosed in reticulated brown lines that resemble a honeycomb, sometimes the brown pigment so extensive that pale spots appear to be on a dark background.
C. sebae (Cuvier and Valenciennes)

5*b*. Dorsal rays XII,13 to 16 (rarely 13 or 14); anal II,15 to 17 (rarely 15).

6*a*. Head and body tan to dark brown, with 8 to 15 vertical dark bars and frequently speckled with tiny black and white dots; narrow dark bar below center of eye, another behind lower rear edge of eye, the latter extending across lip and meeting its fellow on underside of head; narrow transverse dark streak across gill membranes on underside of head; streaks may be diffuse on large specimens; nuchal cirri 25 to 36; length of snout 1.0 to 1.3 in least distance from eye to nuchal fringe.
C. quagga (Fowler and Ball)

6*b*. Head and body dark brown or blackish; no vertical dark bars or streaks near eye or across gill membranes; color pattern consisting of conspicuous roundish pale spots, size of pupil, enclosed in reticulated brown lines that resemble a honeycomb, sometimes brown pigment is so extensive that pale spots appear to be on a dark background; in males, this pattern is confined to throat, breast, and sides of head, but in females it sometimes extends posteriorly as far as the fifth or sixth soft dorsal ray; large males have the posterior half or two-thirds of side of body with numerous white markings varying from round white dots or small spots to elongate ones or white lines that extend vertically, obliquely, or horizontally; some of elongate lines may run together; posteriorly both sexes may have scattered pupil-sized blackish spots or short lines on dark background; nuchal cirri 32 to 42.
C. stigmaticus Strasburg and Schultz

CIRRIPECTES FUSCOGUTTATUS Strasburg and Schultz

PLATE 113,B

Cirripectus fuscoguttatus STRASBURG and SCHULTZ, Journ. Washington Acad. Sci., vol. 43, No. 4, p. 130, fig. 1, 1953 (type locality, Rongerik Atoll; holotype USNM 113634).

Cirripectes brevis (non Kner) SCHULTZ, Copeia, No. 1, pp. 19–20, 1941; U. S. Nat. Mus. Bull. 180, pp. 272–273, 1943 (Enderbury and Tutuila Islands).—CHAPMAN, *in* de Beaufort and Chapman, Fishes of the Indo-Australian Archipelago, vol. 9, p. 249 (note), 1951.

SPECIMEN STUDIED

Bikini Atoll: 9 stations, 49 specimens, 19 to 99 mm. in standard length.
Rongerik Atoll: 1 station, 12 specimens, 21 to 81 mm.
Eniwetok Atoll: 2 stations, 36 specimens, 22 to 100 mm.
Kwajalein Atoll: 1 station, 1 specimen, 72 mm.
The above specimens represent the holotype and paratypes.

Description.—Dorsal rays XII,14; anal II,15 (first anal spine embedded in females); pectoral 15 (with lower 5 or 6 thickened); pelvics I,4; branched caudal 5+4; fringe of cirri on nape 47 to 62; nasal cirri 4 to 12 and orbital cirri 8 to 18 (more cirri on large adults).

Head 3.0 to 3.2; greatest depth 3.2 to 3.5; longest dorsal spine 4.8 to 5.7; longest thickened pectoral ray 3.7 to 4.0; all in standard length. Eye 3.0 to 5.0; snout 2.3 to 2.8; interorbital space 7.0 to 9.0; postorbital length of head 1.6 to 1.7; least depth of body 2.6 to 3.0; greatest depth of body 1.0 to 1.2; preorbital width 4.5 to 6.0; all in length of head.

Orbital tentacle with a broad flattish base, its distal edge somewhat folded, with numerous long cirri, more in adults; nuchal band of simple cirri, those at middorsal line about same length as those laterally, band curving posteroventrally so that distance between vertical lines through ventrolateral basal tip and anterodorsal edge is contained 4.6 to 5.6 times in postorbital length of head; ventral basal end of nuchal band of cirri blackish, notably swollen even in young and extending ventrally to opposite pupil; snout profile nearly vertical; edge of upper lip with numerous very short papillae (or crenulate in young); lower lip shallowly plicate; no cirri on chin; lateral line arched over pectoral fin then curving to midlengthwise axis of body, ending at caudal fin base; a vertical line through dorsal origin passes just behind lower tip of base of nuchal fringe and just behind pelvic bases; pectoral fin reaches a little past anal origin; anal spines 2, in females, except juveniles, first embedded, in adult males, both are grayish, crenulate and convoluted, swollen dermal pads; a canine tooth present on each side of lower jaw; teeth in both jaws very numerous, of equal size, and movable; sixth pectoral ray from lowermost edge of fin longest; distal edge of caudal fin a little rounded.

Color in alcohol.—Background color brown to light brown; body and head profusely covered with roundish black spots, usually absent from all fins except basally on pectorals; all fins very dark brown or blackish. The color pattern changes with size as follows: From 19 to 30 mm. in standard length the black spots are barely discernible and few in number, the background color is chiefly plain brownish, and dark and light bands on the head are becoming developed. In those 30 to 40 mm. there is on front of snout a prominent V-shape brown mark which is separated by a narrow white band from next black band extending from below eye across upper lip to meet its fellow on chin, there forming a triangular spot; just behind this is a wide white band extending from behind eye across cheek through rear of maxillary, meeting its fellow under head; this pale band is set off sharply by dark brown color of rear of head. From 40 to 55 mm. the large black spots on head and body are prominent, and the pale and dark bands on head are still discernible. Between the length of 55 to 70 the black bands on head begin to break up into dark spots and in those longer than 70 mm. the bands are no longer distinct, having broken into roundish to oblong spots.

The nuchal fringe consists of black cirri, with a swollen basal area at lateral tips, very blackish, even in the 19-mm. specimen; the two anal spines on adult males have swollen dermal pads light grayish in color.

Color when alive.—Background color dark brown, spots blackish; eye crimson (iris); upper edge of caudal fin orange.

Ecology.—This moderately common species was taken in the Lithothamnium ridge area where the surf was strong.

Remarks.—*Cirripectes "leopardus"* of Day, of Schultz, and of Chapman is *Exallias brevis* (Kner) and for the synonymy of *brevis* see Strasburg and Schultz (1953). The statement by Chapman (1951) that *"leopardus"* and *"brevis"* (now *fuscoguttatus*) occur side by side in the Marshalls, Hawaii, and Samoa is incorrect. *C. fuscoguttatus* has not been collected in the Hawaiian Islands or at Johnston Island.

CIRRIPECTES VARIOLOSUS (Cuvier and Valenciennes)

PLATE 116,D,E

Salarias variolosus CUVIER and VALENCIENNES Histoire naturelle des poissons, vol. 11, p. 317, 1836 (type locality, Guam).

Salarias nigripes SEALE, Occ. Pap., Bishop Mus., vol. 1, No. 3, p. 127, 1901 (type locality, Guam).

Cirripectes reticulatus FOWLER, Proc. Acad. Nat. Sci. Philadelphia, vol. 98, p. 173, fig. 39, 1946 (type locality, Riu Kiu Islands).

SPECIMENS STUDIED

Bikini Atoll: 17 stations, 124 specimens, 18 to 82 mm. in standard length.
Rongerik Atoll: 2 stations, 18 specimens, 36 to 65 mm.
Rongelap Atoll: 3 stations, 6 specimens, 34 to 69 mm.
Eniwetok Atoll: 3 stations, 22 specimens, 26 to 75 mm.
Kwajalein Atoll: 1 station, 7 specimens, 49 to 58 mm.

Description.—Dorsal rays XII,14 or 15, usually XII,14; anal II,15 or 16 usually II,15; pectoral 15, with lower 5 or 6 thickened; pelvics I,4; branched caudal 5+4; nuchal fringe with 26 to 39 simple cirri; nasal flap with 3 to 6 simple cirri; orbital flap with 3 to 5 simple cirri.

Head 3.2 to 3.5; greatest depth 3.3 to 3.8; longest dorsal spine 2.9 (male) to 5.3; longest thickened pectoral ray 3.5 to 4.2; all in standard length. Eye 3.6 to 4.8; snout 2.7 to 3.3; interorbital space 10 to 13; postorbital length of head 1.5 to 1.6; least depth of body 2.3 to 2.7; greatest depth of body 0.9 to 1.1; preorbital width 5.4 to 5.8; all in length of head.

Orbital tentacle with cirri arising from a fleshy base; nuchal fringe with cirri, at middorsal line interrupted (one or two cirri usually lacking), its base nearly vertical, curving posteriorly only a little; ventral end of base of fringe of cirri not notably swollen and ending opposite upper part of eye; snout profile nearly vertical; upper lip with numerous very short papillae or crenulate; lower lip shallowly plicate, more or less nonplicate near middle of lower lip; no cirri on chin; lateral line arched over pectoral fin, then curving to midlengthwise axis of body, ending a little in front of caudal fin base; a vertical line through dorsal origin passes just behind lower tip of base of nuchal fringe and scarcely behind pelvic base; pectoral fin reaches just to or little past anal origin; anal spines II, first embedded, both tips with grayish, convoluted and swollen dermal pads (in adult males); one canine tooth on each side of rear lower jaw; teeth in both jaws very numerous, about equal in size in both jaws and movable; fifth or sixth pectoral ray from lowermost edge of fin longest; distal edge of caudal fin rounded; first dorsal spine of male (adults) notably elongate.

Color in alcohol.—Background color of body dark brown, head dark brown or light brown; no dark spots anywhere; usually a few lighter spots more or less visible on preorbital and cheek; fins all brown and anal blackish, upper edge of caudal and distally the anterior part of spiny dorsal, white or clear; no dark vertical bars on body. Peritoneum black.

Color when alive.—Purplish brown to chocolate brown; upper edge of caudal fin orange to yellow; cheeks with crimson spots, tips of dorsal spines and tips of lower pectoral rays, red.

Ecology.—This was the most abundant species of *Cirripectes* encountered on the reef. It occurred in surf and near surf conditions along the Lithothamnium ridge and in coral heads subject to wave action.

Remarks.—*C. variolosus* is close to *C. jenningsi* Schultz but may be separated from it by the latter having only a single simple cirrus over each eye. A restudy of several of the collections made and reported upon by Schultz from the Phoenix and Samoan Islands as *C. variolosus* contain specimens of *C. sebae* and *C. jenningsi.* The large amount of material in the 1946–47 Bikini collections has made possible the separation of these related species.

Ophioblennius vanderbilti Fowler is the young of this species and *Cirripectes reticulatus* Fowler an adult.

CIRRIPECTES SEBAE (Cuvier and Valenciennes)

PLATE 114,A,B

Salarias sebae CUVIER and VALENCIENNES, Histoire naturelle des poissons, vol. 11, p. 323, 1836 (type locality, East Indies).

SPECIMENS STUDIED

Bikini Atoll: 12 stations, 63 specimens, 18 to 99 mm. in standard length.
Eniwetok Atoll: 4 stations, 122 specimens, 18 to 64 mm.
Rongerik Atoll: 3 stations, 7 specimens, 18 to 80 mm.
Kwajalein Atoll: 1 station, 1 specimen, 51 mm.

Description.—Dorsal rays XII,14; anal II,15; pectoral 15, with lower 5 thickened and 6 thickened in adults; pelvics I,4, occasionally I,3; branched caudal 5+4; nuchal fringe with 33 to 42 cirri; nasal flap with 4 to 11 cirri; orbital tentacle with 4 or 5 cirri.

Head 3.1 to 3.7; greatest depth 3.1 to 3.5; longest dorsal spine 3.5 to 5.0; longest thickened pectoral ray 3.7 to 4.4; all in standard length. Eye 2.9 to 5.2; snout 2.5 to 2.9; interorbital space 8.0 to 9.5; postorbital length of head 1.5 to 1.7; least depth of body 2.5 to 2.7; greatest depth of body 0.9 to 1.0; preorbital width 4.9 to 5.1; all in length of head.

Orbital tentacle with cirri arising from fleshy base; nuchal fringe with simple cirri, those at nape about same length as laterally base of this fringe curving a little posteriorly, so that the distance between vertical lines through ventrolateral tip of base and anterodorsal edge is contained 5.5 to 7.0 times in postorbital length of head; ventral basal tip of nuchal fringe opposite upper edge of eye to upper edge of pupil; snout profile nearly vertical; upper lip crenulate or with very small papillae; lower lip somewhat plicate laterally, smooth mesially; no cirrus on chin; lateral line arched over pectoral fin, thence along midlengthwise axis, ending a little in front in base of caudal fin; a vertical line through dorsal fin origin passes just behind lower tip of base of nuchal fringe and just behind base of pelvics; pectoral fin reaches to or a trifle past anal origin; anal spines 2, with swollen convoluted pads in adult males; first anal spine concealed; a strong canine tooth posteriorly on each side of lower jaw, curved posteriorly; teeth in both jaws very numerous, and of about equal size in both jaws, movable; fifth or sixth pectoral ray from lowermost edge of fin longest; posterior edge of caudal fin a little rounded.

Color in alcohol.—Since the color pattern changes remarkably with increase in size, the various stages are described separately:

OPHIOBLENNIUS STAGE, 19 and 20 mm.: All cirri dark; background color light brownish, with vertical bands barely discernible; a tiny blackish spot at rear of lower lip on lower jaw.

YOUNG, 18 to 34 mm.: Background color light tan, with a dark brown band about width of pupil extending from upper end of gill opening to caudal fin base, then fading posteriorly; sometimes black band with roundish black spots, from which vertical bars develop; black spot over pectoral base usually more intense than other spots; upper part of spiny dorsal clear, basal two-thirds dusky.

YOUNG AND HALF GROWN, 25 to 50 mm.: First trace of round white spots on throat observed at 25 mm. standard length, these white spots occur in largest adults; black band replaced by 10 to 12 dark brown bars on sides; at a length of 35 mm. one specimen had the black band and vertical dark brown bars; usually the light spots become distinct at 36 to 40 mm. and from 42 to 45 mm. occur on sides of head, at 36 to 55 mm. the vertical bars are very distinct; usually the pectoral spot is distinct at lengths up to 40 mm.; at 45 or 46 mm. the convoluted dermal pads on first two anal spines begin to develop and are grayish in color; from 50 to 60 mm. this stage overlaps with the next.

OVER 55 mm.: Background color very dark or blackish; vertical bars obscured or absent; white spots, size of pupil occur on throat, breast, side of head, behind pectoral base; sometimes these markings are marbled; adult males, beginning at about 75 mm., have tiny silvery white spots or short lines on the sides; pelvics dark, distal edge of spiny dorsal pale; dorsal part of caudal fin pale; first dorsal spine of adult males elongate, white; distal part of caudal pale or clear.

Ecology.—This species was commonly taken in the Lithothamnium ridge area in the surf or where wave action was strong.

Remarks.—*Salarias* (*Cirripectes*) *polyzona* Bleeker is referred as a synonym of *C. sebae* since it represents the barred stage of coloration. *C. variolosus* and *C. sebae* occur together in the collections made at Bikini; they are distinguished by the 33 to 42 cirri in *sebae* and 29 to 37 in *variolosus* and by the differences in color pattern—chiefly the lack of vertical bars, white spots, and black band in *variolosus.*

CIRRIPECTES QUAGGA (Fowler and Ball)

PLATE 116,A–C

Rupiscartes quagga FOWLER and BALL, Proc. Acad. Nat. Sci. Philadelphia, vol. 76, p. 273, 1924 (type locality, Wake Island).

SPECIMENS STUDIED

Bikini Atoll: 10 stations, 163 specimens, 25 to 67 mm. in standard length.
Rongerik Atoll: 1 station, 34 specimens, 25 to 29 mm.
Eniwetok Atoll: 4 stations, 105 specimens, 27 to 60 mm.
Kwajalein Atoll: 1 specimen, 31 mm.

Description.—Dorsal rays XII,15, rarely XII,14; anal II,16, rarely II,15; pectoral 15, with 5 lowermost thickened in young and

6 thickened in larger adults; pelvics I,4; branched caudal 5+4; nuchal fringe with 25 to 31 cirri; nasal flap with 1 to 5 cirri; and orbital flap with 2 to 4 cirri.

Head 3.6 to 3.8; greatest depth 3.7 to 4.0; longest dorsal spine 2.7 (males) to 5.3; longest thickened pectoral ray 4.2 to 5.1; all in standard length. Eye 3.7 to 4.0; snout 2.8 to 2.9; interorbital space 8 to 10; postorbital length of head 1.5 to 1.6; least depth of body 2.4 to 3.0; greatest depth of body 1.0 to 1.1; all in length of head.

Orbital tentacle with cirri arising from fleshy base; nuchal fringe with simple cirri, all about same length; base of nuchal fringe not curving, or only curving a little posteriorly, usually not enough to make the usual measurement; ventral basal tip of nuchal fringe about opposite upper part of eye; snout profile nearly vertical; upper lip crenulate or with small papillae; lower lip a little crenulate, not notably plicate; no cirrus on chin; lateral line broadly arched over pectoral fin, thence slanting to midlengthwise axis and ending more or less in front of base of caudal fin; a vertical line through dorsal fin origin passes notably behind tips of nuchal fringe, through upper edge of gill opening, and behind base of pelvics; pectoral fin usually not quite reaching to anus; anal spines of adult male each with a swollen convoluted dermal pad; first anal spine of females concealed; a strong canine tooth posteriorly on each side of lower jaw, curved posteriorly; teeth in both jaws fine, very numerous, movable, and of equal size in both jaws; fifth or sixth pectoral ray from lower most edge of fin longest; distal edge of caudal fin truncate or nearly so.

Color in alcohol.—The Ophioblennius stages among the specimens have a standard length of 25 to 31.5 mm.; are light brown, with indications of darker brown bars on sides, with the dark brown streaks and spots on head becoming evident; fins dusky, rear of each lip with a brown spot. Adult stages, which range in length 25 to 67 mm., are colored as follows: Background color of head light brown to brown, usually with a distinct narrow blackish streak below center of eye, extending on upper lip; another just behind lower rear edge of eye extending on lip then interrupted and continuing as a narrow bar on lower lip and on underside of head, sometimes meeting its fellow; behind this dark streak, on gill membranes on underside of head, is a narrow transverse streak sometimes meeting but usually separated from the anterior one; front of snout with 3 to 5 black spots, two of which are usually on upper lip, and in the largest specimens these spots form a V-shaped dark streak from nostrils to tip of upper lip; usually there are about 15 dark brownish vertical bars evident on sides, the first as a saddle just behind nuchal fringe; on large specimens the bars and dark streaks on head may become diffuse; first dorsal spine of adult males elongate, and usually whitish; fins all dusky except dorsal part of caudal and pectorals.

Ecology.—*C. quagga*, like its relatives in the Marshalls, typically occurs in the surf in the Lithothamnium ridge.

CIRRIPECTES STIGMATICUS Strasburg and Schultz

PLATE 113,C–E

Cirripectes stigmaticus STRASBURG and SCHULTZ, Journ. Washington Acad. Sci., vol. 43, No. 4, p. 132, fig. 2, 1953 (type locality, Rongerik Atoll; holotype USNM 164962).

SPECIMENS STUDIED

Bikini Atoll: 1 station, 2 specimens, 93 to 99.5 mm. in standard length.
Rongerik Atoll: 2 stations, 4 specimens, 62 to 82 mm.
Arno Atoll: 2 lots, 5 specimens, 45 to 81 mm.
The above specimens represent the holotype and some of the paratypes.

Description.—Certain counts are recorded in table 109. Dorsal rays XII,14 to 16, rarely 14 or 16; anal II,15 or 16, rarely 15 (first anal spine embedded on females); pectoral 14 to 16, rarely 14 or 16 (with lower 5 or 6 thickened); pelvics I,4; branched caudal rays 5+4; fringe of cirri on nape 32 to 42, generally 35 to 42; nasal cirri 4 to 6; supraorbital cirri 4 to 10 (more cirri on large adults).

Head 2.9 to 3.1; greatest depth 3.1 to 3.3; longest dorsal spine (first elongate in adult males) 1.9 to 2.9; longest thickened pectoral ray 2.1 to 2.6; all in standard length. Eye 3.5 to 4.7; snout 2.4 to 3.1; interorbital space 7.7 to 13.3; postorbital length of head 1.5 to 1.7; least depth of body 2.5 to 3.0; greatest depth of body 0.87 to 0.96; all in length of head.

Orbital tentacle with a broad flattened base, its distal edge with numerous long cirri, more in adults; nuchal band of cirri simple, those at middorsal line about same length as those laterally, nuchal band of cirri curving posteroventrally so that the distance between vertical lines through ventrolateral basal tip and anterodorsal edge is contained 4.6 to 6.5 times in postorbital length of head; ventral basal end of nuchal band of cirri is notably swollen and flattened even in young; it is blackish and bears the lowermost 8 or 9 cirri, and extends ventrally to about upper edge of pupil; snout profile nearly vertical; edge of upper lip with numerous short papillae or crenulate in young; lower lip with mesial third smooth, lateral third on each side somewhat plicate; no cirri on chin; lateral line arched over pectoral fin then curving to midlengthwise axis of body, ending at caudal fin base; vertical line through dorsal origin passes just behind ventral tip of nuchal fringe base and just behind pelvic bases; pectoral fin reaches a little past anal origin; anal spines 2, first embedded on females past the Ophioblennius stage, both free on males; adult males have crenulate and convoluted spongy masses on these spines; a

TABLE 109.—*Counts recorded for species of* Cirripectes *and* Exallias *from the Marshall, Gilbert, Phoenix, and Samoan Islands*

Genus and species	Fin rays																Cirri																																						
	Dorsal							Anal					Pectoral				Nuchal																				Supraorbital																	
	XII	XIII	12	13	14	15	16	II	14	15	16	17	13	14	15	16	24 25	26 27	28 29	30 31	32 33	34 35	36 37	38 39	40 41	42 43	44 45	46 47	48 49	50 51	52 53	54 55	56 57	58 59	60 61	62 63	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Exallias brevis [1]	29	------	4	25	--	--	--	29	27	2	--	--	--	--	42	--	--	--	--	2	8	16	3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2	6	5	14	4	14	6	4	1	1	--	--	1	--	--
Cirripectes:																																																						
fuscoguttatus	26	------	--	--	26	--	--	26	--	26	--	--	--	--	41	--	--	--	--	--	--	--	--	--	--	--	--	2	1	6	9	5	1	1	--	2	--	--	--	--	--	--	--	2	--	1	2	3	7	8	2	3	1	3
variolosus	30	------	--	--	30	--	--	30	1	29	--	--	--	--	28	--	--	--	1	11	11	4	2	--	--	--	--	--	--	--	--	--	--	--	--	--	1	--	13	34	6	4	--	2	--	--	--	--	--	--	--	--	--	--
sebae	85	------	--	2	83	--	--	85	2	83	--	--	--	4	108	8	--	--	--	--	3	11	24	21	16	7	--	--	--	--	--	--	--	--	--	--	3	11	26	38	45	31	12	4	--	--	--	--	--	--	--	--	--	--
filamentosus [2]	34	1	--	--	10	25	--	35	--	9	26	--	2	5	61	2	7	18	8	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2	23	36	8	1	--	--	--	--	--	--	--	--	--	--	--	--	--
jenningsi [3]	24	------	--	--	--	24	--	24	--	1	23	--	--	1	47	--	--	1	--	--	--	2	3	7	6	5	--	--	--	--	--	--	--	--	--	--	48	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
quagga [4]	29	------	--	1	1	27	--	29	--	3	24	1	--	2	49	--	1	4	5	12	5	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	16	11	14	12	3	1	--	1	--	--	--	--	--	--	--	--	--	--
stigmaticus	28	------	--	--	1	26	1	28	--	1	27	--	--	3	42	1	--	--	--	--	1	5	8	8	4	2	--	--	--	--	--	--	--	--	--	--	--	--	--	8	15	21	7	3	1	1	--	--	--	--	--	--	--	--

[1] These data include counts made on 15 specimens from Johnston Island and the Hawaiian Islands.

[2] All counts made on specimens from Arnhem Land, northern Australia.

[3] Not taken in the Marshall Islands.

[4] Two specimens from Wake Island included in the counts.

canine tooth present on each side of lower jaw; teeth in both jaws very numerous, of about equal size, and movable; fifth or sixth pectoral ray from lowermost edge of fin longest; distal edge of caudal fin a little rounded.

Color in alcohol.—Background color brown to blackish; vertical fins dark and unmarked except for anterodorsal part of the spinous dorsal, the distal tips of the first few soft dorsal rays, and the upper lobe of the caudal, which may be pale or whitish; anal somewhat darker than body or other fins, pelvics dusky, pectorals dusky ventrally, paler dorsally.

The color pattern changes with size as follows: The smallest specimen available (35.8 mm. in standard length) has the background color brown, with the cheeks, opercles, and sides of the body posteriorly to the tip of the depressed pectoral overlaid with round pale spots about the size of the pupil. Posterior to the pectoral tips these spots are enlarged so much that the surrounding brown areas have the appearance of irregular lines on a pale background. The vertical fins of this specimen are pale brown basally becoming almost transparent in their distal half to two-thirds. The spinous dorsal is marked with a dusky lengthwise stripe along its basal third; this demarks the distal pale area mentioned above.

In specimens above 40 mm. in standard length the characteristic, although somewhat variable, adult color pattern has been attained. The roundish pupil-sized pale spots are much more distinct, sometimes they are enclosed in reticulated brown lines that resemble a honeycomb, and sometimes the brown pigment is so extensive that the spots appear to be on a dark background. The nuchal fringe consists of black cirri with a swollen, very blackish basal area laterally.

The distribution of the spots and other markings varies with sex as follows:

MALES: Spots on preorbitals and suborbitals, cheeks, opercles, entire under side of head and throat, and extending posteriorly on the pectoral bases. The posterior one-half to two-thirds of the sides of the body are covered with numerous white markings that may vary from round white dots or small spots to elongate ones or white lines that extend vertically, horizontally or obliquely; some of these lines may run together. There may be a few blackish pupil-sized dots or irregular markings on the sides of the caudal peduncle. The dermal pads on the anal spines of males are grayish to blackish.

FEMALES: Pale spots as in males; these may extend as far posteriorly as the fifth or sixth dorsal soft ray. Posterior to this the spots give way to plain dark color or there may be irregular blackish dots or short lines on a dark background.

Color when alive.—Background color brown to blackish, anterior spots pale brown, sides of males covered with bright red dots or elongate spots or lines; anterodorsal tip of first and second dorsals and upper lobe of caudal reddish orange to white.

Ecology.—This rather uncommon species was taken in the Lithothamnium ridge area or areas of *Acropora* and *Pocillopora* corals where the surf was moderate to strong.

Genus RHABDOBLENNIUS Whitley

Rhabdoblennius Whitley, Mem. Queensland Mus., vol. 10, p. 20, 1930 (type species, *Blennius rhabdotrachelus* Fowler and Ball).

Nixiblennius Whitley, Mem. Queensland Mus., vol. 10, p. 20 (type species, *Blennius snowi* Fowler).

Antennablennius Fowler, Proc. Acad. Nat. Sci. Philadelphia, vol. 83, p. 245, 1931 (type species, *Blennius hypenetes* Klünzinger).

Scartoblennius Fowler, Proc. Acad. Nat. Sci. Philadelphia, vol. 98, p. 174, 1946 (type species, *Blennius ellipes* Jordan and Starks).

This genus is best characterized by its lower-jaw teeth, which are scarcely movable or not movable, in contrast to the freely movable lower-jaw teeth of *Salarias* and *Istiblennius*. The species of *Rhabdoblennius* from the Marshall and Marianas Islands, as represented by collections in the U. S. National Museum, are separated by the following key:

1*a*. Upper posterior part of opercle with a dark spot; under side of head plain dusky or with a broad paler transverse area across its middle; background coloration pale, with 2 or 3 rows of brown spots on sides representing the vertical bars; midbase of caudal fin with light dusky spot; head usually with several small bright white spots__**R. snowi** (Fowler)

1*b*. No dark opercular spot; side and lower side of head usually with 3 dusky transverse streaks, one behind corner of lower lip, second from preopercular edge; third along rear edge of gill membranes, these dark streaks extend on under side of head but do not meet along midventral line, that area is unpigmented; vertical bars represented by faintly pigmented area a little above lengthwise axis; no dark spot at midbase of caudal fin__________________**R. rhabdotrachelus** (Fowler and Ball)

RHABDOBLENNIUS SNOWI (Fowler)

Plate 115,A

Blennius snowi Fowler, Mem. Bishop Mus., vol. 10, p. 431, fig. 71, 1928 (type locality, Strong's Island, Caroline Islands).

SPECIMENS STUDIED

Bikini Atoll: 9 stations, 94 specimens, 18 to 42 mm. in standard length.
Rongerik Atoll: 4 specimens, 27 to 32 mm.
Eniwetok Atoll: 3 stations, 12 specimens, 19 to 40 mm.
Rongelap Atoll: 3 stations, 145 specimens, 13 to 46 mm.
Kwajalein Atoll: 3 specimens, 32 to 33 mm.
Northern Marshall Islands: 1 lot, 17 specimens, 33 to 46 mm.
Guam: 2 lots, 5 specimens, 33 to 44 mm.

Description.—Dorsal rays XII,18 or 19; anal II,19 to 21; pectoral 14 with lower 5 rays swollen; branched caudal fin rays 5+4; pelvics I,3; orbital cirrus simple; no nuchal cirrus; nasal cirrus simple.

Head 3.9 to 4.2; greatest depth 5.1 to 5.5; longest pectoral ray 4.1 to 4.8; snout tip to anus 2.3; anal fin base 2.2 to 2.3; all in standard length. Eye 3.1 to 3.2; snout 2.8 to 3.0; postorbital length of head 1.6 to 1.7; greatest depth of body 1.3; least depth 2.9 to 3.1; longest pectoral ray 1.1 to 1.2; longest dorsal spine 1.9 to 2.1; all in length of head. Fleshy interorbital space 2.5 to 3.0 in eye.

Orbital tentacle simple, slender, a little flattened in cross section, its length from a third to four-fifths eye diameter; no nuchal cirrus; nasal cirrus very short, simple, thin, broader than thick; snout profile nearly vertical; edge of both lips smooth; lateral line over pectoral fins, not descending to midlengthwise axis, ending about opposite three-fourths the length of pectoral; vertical line through dorsal origin passes through base of pelvic fins; dorsal fin with a very slight emargination over last dorsal spine; last soft dorsal ray with membrane attaching it to dorsal edge of caudal peduncle; anal fin with membrane attaching last ray to ventral edge of caudal peduncle; anal fin origin about under base of second from last dorsal spine; pectoral fin reaching to anus; anal spines small, first embedded in female; first anal rays of adult males not notably swollen at tips; posterior canines present in lower jaw; teeth small, numerous, fixed in both jaws; vomer with a few short conical teeth; distal margin of caudal fin a little rounded; no cephalic crest.

Color in alcohol.—Background coloration whitish to light tan, with 7 or 8 blackish or brownish blotches representing vertical bars on body, these intensified along midlengthwise axis, where they form dark spots, and anteriorly a smaller dark spot occurring between the larger ones; the vertical dark bars continue faintly to anal base; a dark spot or blotch in upper part of opercle, another at midbase of caudal fin, totaling usually 14 dark blotches along middle of sides; the vertical dark bars on sides continue dorsally as double dark blotches and extend onto basal two-thirds of dorsal fin; underside of head dusky anteriorly; whitish posteriorly; head often with scattered small bright white spots, finely edged with a brown line; pelvics and pectoral pale.

Ecology.—This species occurred mostly on the ocean reef and in shallow pools left at low tide on the flat parts of the reef or in pools near the high tidal level where wave action was strong; in the lagoon it occurred where wave action was strong on the reef. The species was more abundant if crevices were present in pools in the beach rock or if other protection occurred.

Remarks.—The darkly pigmented spots on this species occurred along the midlengthwise axis, whereas in *R. rhabdotrachelus* the dark pigment spots were a little above that axis, especially posteriorly; the dark spot at midbase of caudal fin was persistent even in the smaller specimens.

RHABDOBLENNIUS RHABDOTRACHELUS (Fowler and Ball

PLATE 115,B

Blennius rhabdotrachelus FOWLER and BALL, Proc. Acad. Nat. Sci. Philadelphia, p. 272, 1924 (type locality, Wake Island).

SPECIMENS STUDIED

Bikini Atoll: 15 stations, 257 specimens, 12 to 39 mm. in standard length.
Rongerik Atoll: 2 stations, 11 specimens, 16 to 31 mm.
Rongelap Atoll: 4 stations, 164 specimens, 12 to 41 mm.
Eniwetok Atoll: 2 stations, 27 specimens, 10 to 34 mm.
Guam: 4 lots, 43 specimens, 16 to 34 mm.
Saipan: 1 specimen, 28 mm.

Description.—Dorsal rays XII,18 or 19; anal II,20 or 21, pectoral 14 with lower 5 rays swollen; branched caudal 5+4; pelvics I,3; orbital cirrus single; no nuchal cirrus; nasal cirrus single.

Head 4.0 to 4.4; greatest depth 5.0 to 5.8; longest pectoral ray 4.1 to 4.7; snout tip to anus 2.4 to 2.5; anal fin base 1.9 to 2.1; all in standard length. Eye 3.5 to 4.2; snout 3.1 to 3.5; postorbital length of head 1.6; greatest depth of body 1.3 to 1.4; least depth 3.0 to 3.2; longest pectoral ray 1.0 to 1.1; longest dorsal spine 2.0 to 2.1; all in length of head. Fleshy interorbital space 3.3 to 3.6 in eye.

Orbital tentacle simple, slender, rounded in cross section, its length from half to nearly as long as eye diameter; no nuchal cirrus; nasal cirrus simple, short, snout profile with a slight backward slant of about 5 degrees from the vertical; edge of both upper and lower lips smooth; lateral line arched over axil of pectoral, descending to near midlengthwise axis of body opposite last third of length of pectoral fin and ending opposite tip of pectoral fin, notably in front of a vertical line through anus; vertical line through dorsal origin passes through base of pelvic fins; dorsal fins without an emargination over last dorsal spine; last soft dorsal ray with a membrane attaching it to dorsal edge of caudal peduncle but not to caudal fin base; last ray of anal fin with a membrane attaching it to ventral edge of caudal peduncle; anal fin origin under base of second or third from last dorsal spine; pectoral fins reaching to anus; anal spines small, in females the first embedded; first anal rays of adult males not notably swollen at tips; posterior canine on lower jaw present; teeth small, numerous, fixed in both jaws; vomer with some short conical teeth; distal margin of caudal fin rounded; no cephalic crest.

Color in alcohol.—Background coloration whitish to light tan, with about 7 or 8 vertical bars represented by areas of slightly darker pigment, mostly above midlengthwise axis of body, especially posteriorly; dorsal fin dusky in areas corresponding to dusky vertical bars on body but edge of dorsal fin white; anal fin dusky; pelvics and the basal area nearby dusky, especially on adult males; often three dusky transverse streaks occur on each lower side of head, one behind corner of lower lip, second from preopercular edge and third along rear edge of gill membranes; these dark streaks do not meet along midline of under side of head, that area being unpigmented. The dark areas are a small faint blotch on the young specimens and are absent or only very faint in those about 13 to 15 mm. in standard length.

Ecology.—This common species was encountered on reefs exposed to strong wave action and in the high tidal solution channels, where surflike conditions also occur. At low tide, members of this species remained in the solution channels or appeared on the exposed flat parts of the reefs where water was a few inches deep.

Genus ECSENIUS McCulloch

Ecsenius McCulloch, Rec. Australian Mus., vol. 14, p. 121, 1923 (type species, *Ecsenius mandibularis* McCulloch).—Norman, Ann. Mag. Nat. Hist., ser. 11, vol. 10, p. 810, 1943.

This genus was revised by Chapman and Schultz (Proc. U. S. Nat. Mus., vol. 102, pp. 507–528, figs. 90–96, 1952). The following key was modified from that study.

KEY TO THE SPECIES OF ECSENIUS

1*a*. (See also 1*b* and 1*c*) Pectoral with 15 rays and no dark spot around anus.
  2*a*. Color of head, body and vertical fins a rich, uniform brown, with no markings; dorsal rays XII,19; anal II,20. (Red Sea.) **E. frontalis**[5] (Cuvier and Valenciennes)
  2*b*. Color of head and body light tan with no markings other than a few scattered black specks on upper part of caudal peduncle; a jet black band as wide as eye diameter running along base of both spinous and soft dorsal, outer part of fin hyaline; top and bottom of caudal fin jet black to end of long rays, rest of fin hyaline; anal fin colorless; dorsal rays XII,18; anal II,20. **E. gravieri**[6] (Pellegrin)
1*b*. Pectoral rays 13 to 15, usually 14; anal rays II,18 or 19; a distinct dark spot around anus; a large black spot on base of caudal fin; dark brown line from lower edge of eye backward across gill cover; dorsal rays XII,16 or 17. (Philippines.) **E. stigmatura**[7] Fowler

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[5] *Salarias frontalis* Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 11, p. 328, 1836 (type locality, Massuah, Red Sea).

Ecsenius frontalis Chapman and Schultz, Proc. U. S. Nat. Mus., vol. 102, p. 512, 1952.

[6] *Salarias gravieri* Pellegrin, Bull. Mus. Hist. Nat. Paris, vol. 12, p. 93, 1906 (type locality, Djibouti).

Ecsenius gravieri Chapman and Schultz, Proc. U. S. Nat. Mus., vol. 102, p. 513, 1952.

[7] *Ecsenius stigmatura*, Fowler *in* Chapman and Schultz, Proc. U. S. Nat. Mus., vol. 102, p. 514, fig. 90, 1952 (type locality, Philippine Islands; holotype USNM 99379, paratypes USNM 111878 and 122444).

This species was found by Schultz among specimens studied by H. W. Fowler, and which Fowler had labeled as a new species of *Salarias*. It was described with his permission.

1*c*. Pectoral with 13 or 14 rays (rarely 12); if area around anus is black anal rays are II,13 or 14.

3*a*. Nasal cirrus simple and single.

4*a*. Dorsal with 19 or 20 soft rays; anal with 21 or 22; a dark band along base of dorsal. (Western Indian Ocean and Persian Gulf.)

5*a*. Body evenly brown, without markings (female). **E. pulcher** (Murray)

5*b*. Head, throat and body to level of sixth dorsal ray rich, light brown (paler below), without markings; rest of body to caudal abruptly pale, crossed by 5 or 6 equally spaced narrow, sharply defined vertical bars, reaching from dorsal to ventral edge of body (male). **E. pulcher**[8] (Murray)

4*b*. Dorsal with 12 to 14 soft rays; anal with 13 to 17 soft rays; no dark streak along base of spinous dorsal and streak never sharply defined if present on soft dorsal.

6*a*. Spinous and soft dorsal separated by shallow notch in young but no notch at all in adults; sharply defined black spot, half the area of eye, around anus, set off from rich brown body by light peripheral band; no other markings on head, body or fins; dorsal with 12 or 13 soft rays; anal with 13 or 14 soft rays. (Solomon Islands.) **E. lividanalis**[9] Chapman and Schultz

6*b*. Spinous and soft dorsal separated by a deep notch reaching nearly to base of fin; last dorsal spine minute, nearly hidden in basal fin membrane; no dark spot around anus; well defined dark streaks, bars, or spots on body; dorsal with 13 to 16 soft rays; anal with 15 to 18 soft rays.

7*a*. A row of 6 or 7 small teeth laterally on ridge of dentary; anal with 16 to 18 soft rays; double row of small, dark, roundish spots along side of body, but no bars or bands. (Queensland, Australia.)----------------------**E. mandibularis**[10] McCulloch

7*b*. One or 2 tiny teeth posterolaterally on the dentary, but never more; anal with 15 soft rays; no dark spots on body, but dark bars or bands present on sides; two pale horizontal bands, each as wide as pupil, running full length of body, one from upper corner of opercle, the other from under pectoral.

8*a*. Dorsal with 14 soft rays; a dark band as wide as pupil extending back from eye to opercle edge; no vertical dark bars on body; nasal cirrus about a third the diameter of eye in length; membrane from last dorsal ray covering first 3 or 4 small caudal rays; pectoral shorter than head by diameter of eye;

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[8] *Salarias pulcher* Murray, Journ. Bombay Nat. Hist. Soc., vol. 2, p. 47, 1887 (type locality, Kurrachee Manora Rocks, India); Indian Ann. Mag. Nat. Sci., vol. 1, p. 23, 1887 (Kurrachee).

Salarias phantasticus Boulenger, Ann. Mag. Nat. Hist., ser. 6, vol. 20, p. 422, 1897 (type locality, Mekran Coast, Persia).

Salarias anomalus Regan, Journ. Bombay Nat. Hist. Soc., vol. 16, pp. 327–331, pl. B, fig. 4, 1905 (type locality, Persian Gulf; Mekran Coast, Karachi); Journ. Zool. Soc. London, p. 406, 1909 (on type material).

Ecsenius pulcher Chapman and Schultz, Proc. U. S. Nat. Mus., vol. 102, p. 515, 1952.

[9] *Ecsenius lividanalis* Chapman and Schultz, Proc. U. S. Nat. Mus., vol. 102, p. 517, fig. 91, 1952 (type locality, Munda, New Georgia, Solomon Islands; holotype USNM 144723, and paratype USNM 144291).

[10] *Ecsenius mandibularis* McCulloch, Rec. Australian Mus., vol. 14, No. 2, p. 122, pl. 15, figs. 1, 2, 1923 (type locality, Masthead Island, off Port Curtis, Queensland, Australia).—Chapman and Schultz, Proc. U. S. Nat. Mus., vol. 102, p. 518, 1952.

pelvics shorter than post orbital length of head by about one-third the diameter of eye. (Solomon Islands.)
E. pro-oculis[11] Chapman and Schultz

8*b*. Dorsal with 13 soft rays; dark band from eye extending beyond opercular edge onto body to a vertical from middle of spinous dorsal; 8 or 9 narrow, dark, vertical bars on body extending to base of dorsal, where 2 or 3 may be divided; nasal cirrus about half the diameter of eye in length; membrane of last dorsal ray not covering first few caudal rays; pectoral shorter than head by less than half the diameter of eye; pelvics longer than post-orbital length of head by nearly half the diameter of eye. (Marshall Islands.)
E. opsifrontalis Chapman and Schultz

3*b*. Nasal cirrus always double, ventral one may be bifid or double; dorsal with 16 to 20 soft rays; anal with 19 to 21 soft rays.

9*a*. Head and anterior part of body evenly dark with no markings; posterior part of body and adjacent vertical fins often abruptly pale (bright golden in life) with no markings.

10*a*. Dorsal with 16 or 17 soft rays; anal with 8 to 20 soft rays. (Eastern Indian Ocean; Christmas Island; Timor; New Hebrides Islands.)
E. bicolor[12] (Day)

10*b*. Dorsal with 20 soft rays; anal with 21 soft rays. (Formosa.)
E. namiyei[13] (Jordan and Evermann)

9*b*. Middle of side of body with 5 to 7 short but distinct white bars evenly spaced; a dark spot behind eye; middle caudal fin rays dusky to blackish; body plain olive to light greenish brown, undersides pale olive; figure 116__________**E. hawaiiensis**[14] Chapman and Schultz

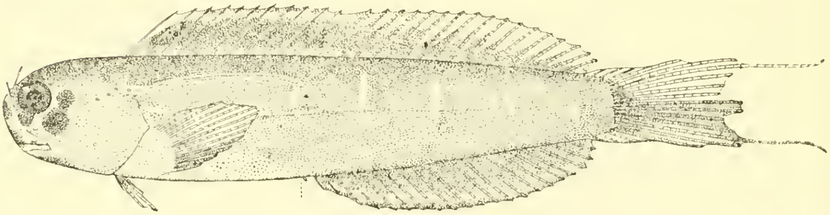

FIGURE 116.—*Ecsenius hawaiiensis* Chapman and Schultz, holotype, USNM 112293, from Pearl Harbor. Drawn by A. M. Awl.

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[11] *Ecsenius pro-oculis* Chapman and Schultz, Proc. U. S. Nat. Mus., vol. 102, p. 519, fig. 92, 1952 (type locality, Munda Lagoon, New Georgia, Solomon Islands; holotype USNM 144722).

[12] *Salarias bicolor* Day, Supplement to the fishes of India, p. 798 (on Tickell ms.) 1888 (type locality, Saddle Island, Kyoukphyoo Aracan); *in* Blanford, fauna of British India . . ., Fishes, vol. 2, p. 323, 1889 (on type material).—Weber, *Siboga*-Expeditie, vol. 57, p. 533, 1913 (eastern tip of Timor).

Salarias furcatus (non de Vis 1884) Johnstone, Report of Ceylon Pearl Oyster Fisheries, vol. 2, no. 15, p. 213, pl. 1, fig. 4, 1904 (type locality, Chilam Paar, Ceylon).—Whitley, Rec. Australian Mus., vol. 17, no. 3, p. 136, 1929).

Salarias burmanicus Hora and Mukerji, Rec. Indian Mus., Calcutta, vol. 38, p. 34, 1936 (type locality, Maung Magan, Tavoy District, lower Burma).

Ecsenius bicolor, Chapman and Schultz, Proc. U. S. Nat. Mus., vol. 102, p. 522, fig. 94, 1952.

[13] *Salarias namiyei* Jordan and Evermann, Proc. U. S. Nat. Mus., vol. 25, p. 362, fig. 25, 1902 (type locality, Pescadores Islands.

Ecsenius namiyei Chapman and Schultz, Proc. U. S. Nat. Mus., vol. 102, p. 525, fig. 95, 1952.

[14] *Ecsenius hawaiiensis* Chapman and Schultz, Proc. U. S. Nat. Mus., vol. 102, p. 526, fig. 96, 1952 (type locality, Oahu Island, Pearl Harbor; holotype USNM 112293; paratypes USNM 112294; it is possible that this species may have come from Guam).

TABLE 110.—*Counts on certain species of* Ecsenius

Species	Fin rays																				Basal tentacles on each nostril		
	Dorsal								Anal									Pectoral					
	XII	12	13	14	15	16	17	18	II	13	14	15	16	17	18	19	20	12	13	14	15	1+0	1+1	1+2
bicolor	11					4	6	1	11							8	3		20	2			18	4
hawaiiensis	13					3	9	1	13						1	10	2	1	24	1			25	1
opsifrontalis	2		2						2			2							6			6		
stigmatura	3					1	2		3						1	2			1	3	2	6		
lividanalis	10	1	8	1					9	2	7								9			6		
pro-oculis	1			1					1			1							2			2		

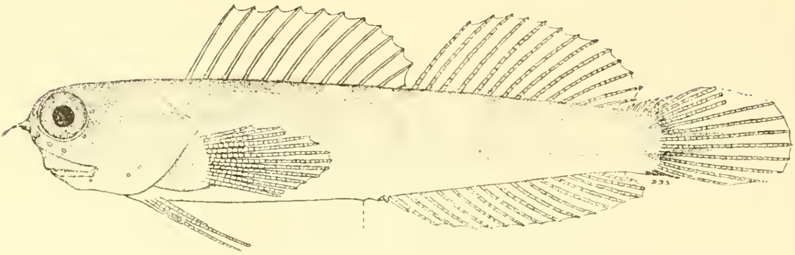

FIGURE 117.—*Ecsenius opsifrontalis* Chapman and Schultz, holotype, USNM 142065, from Rongelap Atoll. Drawn by Dorothea B. Schultz.

ECSENIUS OPSIFRONTALIS Chapman and Schultz

FIGURE 117

Ecsenius opsifrontalis CHAPMAN and SCHULTZ, Proc. U. S. Nat. Mus., vol. 102, p. 521, fig. 93, 1952 (type locality, Rongelap Atoll, Marshall Islands).

SPECIMENS STUDIED

Rongelap Atoll: Holotype, USNM 142065, standard length 31 mm.

Bikini Atoll: Paratype, USNM 142066, standard length 26.3 mm., Univ. Washington, 1 lot, 2 specimens, 33 to 35.5 mm.

Description.—See table 110 for counts.

Head (tip of snout or front of upper lip to end of gill cover) 3.5 to 3.6; greatest depth 4.6 to 4.8; longest pectoral ray 4.0 to 4.2; snout tip to anus 1.9; anal fin base 2.7 to 2.9; all in standard length. Eye 3.0 to 3.1; snout 3.1 to 3.4; postorbital length of head 1.4; greatest depth of body 1.3 to 1.4; least depth of body 2.5 to 2.6; longest pectoral ray 1.3; longest dorsal spine 1.8 to 1.9; all in length of head from tip of upper lip (snout) to rear of gill cover. Fleshy interorbital space 2.5 to 3.0 in eye.

No orbital cirrus; no nuchal cirrus; a single, simple nasal cirrus arising on upper edge of nasal opening; snout profile with a notable backward slant of 30 to 45 degrees from the vertical; edges of both lips smooth; lateral line running a dorsal course over pectoral fin (with only a slight arch) and ending opposite anus without descending to midlengthwise axis; vertical line through dorsal origin passes just behind pelvic bases; a membrane attaches last dorsal ray to upper edge of caudal peduncle but not to base of caudal fin; anal origin opposite base of last or next to last dorsal spine; last anal ray with membrane attaching it to ventral edge of caudal peduncle; pectoral fins not reaching to anus; anal spines small, first embedded on female but not on male, tips of first anal rays not swollen; posterior canines on lower jaw present but minute and hidden; teeth in upper jaw fine, very numerous, movable; teeth in lower jaw about 50 in number, slightly larger, the last 2 or 3 lateral teeth notably broader and larger than others in lower jaw; no vomerine teeth; posterior margin of caudal fin truncate or nearly so; no cephalic crest; a vertical line through front edge of upper lip passes through front edge of pupil, the eyes and forehead far forward; all fin rays unbranded.

Color in alcohol.—Background coloration light brown; a dusky streak beginning about opposite middle of spiny dorsal base a little below lateral line and on level of pupil extends forward to rear edge of eye, midsides of body with 8 or 9 narrow dusky vertical bars that extend to base of dorsal fin, and some of them breaking up to form 10 or 11 dorsally; the last bar is V-shaped with the open end posteriorly and continuing a short distance out on base of caudal fin; edges of both lips dusky; anal fin submarginally with a dusky streak, tips of rays white.

Ecology.—This species was found among coral heads in water from 18 to 25 feet depth. It was never taken in the tidal zone on the reefs.

Genus ENTOMACRODUS Gill

Entomacrodus Gill, Proc. Acad. Nat. Sci. Philadelphia, vol. 11, p. 168, 1859 (type species, *Entomacrodus nigricans* Gill).

Salariichthys Guichenot, Mem. Soc. Sci. Nat. Cherbourg, vol. 13, p. 96, 1867 (type species, *Salarias vomerinus* Cuvier and Valenciennes).

This genus is recognized by the row of very small short bluntly conical teeth on head of vomer. See table 111 for fin-ray counts of various species of the genus.

KEY TO THE SPECIES OF ENTOMACRODUS FROM THE NORTHERN MARSHALL AND MARIANAS ISLANDS

1*a*. Orbital tentacle, single, simple, its length usually from 1.1 to 2 times diameter of eye, rarely with a single cirrus on inner edge; middle third of edge of upper lip crenulate, lateral third smooth; a dark spot on dorsal fin membrane between first two spines; posterior canines minute, barely piercing skin of jaw.

  2*a*. Dorsal rays XIII,16 or 17; anal II,18; nasal flap without cirri. (Japan, Okinawa, Marianas.) .... **E. stellifer** (Jordan and Snyder)

  2*b*. Dorsal rays XIII,15; anal II,16 or 17; nasal flap with a few cirri. (Singapore; Amoy, China.) .... **E. lighti** (Herre)

1*b*. Orbital tentacle equal to or shorter than eye, its inner edge with from 2 to 7 cirri (in young, only 1), edge of upper lip not as above; posterior pair of canines in lower jaw well developed; no prominent black spot between first two dorsal spines.

  3*a*. (See 3*b* and 3*c*) Edge of upper lip smooth throughout its length; orbital tentacle with 2 or 3 cirri on its inner edge, none on outer edge; nuchal cirrus small, sometimes absent but usually present; a small black spot a little behind eye; background coloration whitish or light tan with traces of dusky pigment forming a few faint spots along sides, the most persistent one opposite tips of pectoral rays.
  E. thalassinus (Jordan and Seale)

3*b*. Middle third of upper lip smooth, outer third of each side crenulate; orbital tentacle single, inner edge with from 2 to 4 cirri, no cirrus on outer edge; nuchal pair of cirri present; no definite dark blotch behind eye.

4*a*. A black spot just above and behind pectoral fin base. (Christmas Island; Indian Ocean; Philippines; Tau and Swains Islands.) **E. caudofasciatus** (Regan)

4*b*. No black spot above and behind pectoral fin base. (Marshall, Marianas, Samoan Islands.)__________**E. incisolabiatus**, new species

3*c*. Entire edge of upper lip crenulate.

5*a*. (See 5*b*, 5*c*) Nuchal tentacle, single, rather broad based, and sometimes with 1 or 2 short cirri on its edges; orbital tentacles rather large, nearly as long as eye diameter, both edges multicirrate; nasal flap palmate with pedunculate base, then a broad thin flap with numerous cirri distally; background color light gray to tan, head and body profusely blotched with dark brown, more or less arranged to form 6 double but highly irregular vertical bars; dorsal, anal, caudal, and pectoral fins barred with dark brown, pectoral base with brown bar; then whitish bar posteriorly on base; dusky bar below eye; dorsal rays XIII,17; anal II,17 to 19. **E. decussatus** (Bleeker)

5*b*. Nuchal tentacle, simple, single, without cirri on its edges; coloration not as above.

6*a*. Orbital tentacles with at least 2 or 3 cirri that arise basally and not from distal edges of a single main dermal cirrus; background coloration light tan or whitish with traces of some tiny patches of dark pigment cells dorsally; side of head with 3 lightly pigmented dark streaks, first close behind eye, with an intensification of pigment forming a spot just behind eye, then a white streak followed by a dark streak, then a white streak followed by a thin line of dark pigment cells across opercle; dorsal rays XIII,13 or 14; anal II,15; (a small species, with adults 23 to 27 mm. in standard length)________**E. cymatobiotus**, new species

6*b*. Orbital tentacle with a single base, on its inner edge from 1 to 7 cirri, outer edge with or without cirri.

7*a*. Dorsal rays XIII,17, rarely XIII,16; anal II,18, rarely II,19; orbital tentacle with from 1 to 7 cirri on both inner and outer edges, number of cirri increasing with size of specimen; background coloration light tan, with vertical bars represented by dark brown markings; along midside of specimens as long as 65 mm. a series of pale-centered dark brown spots, anterior and posterior ones sometimes not pale centered, or they are open ventrally; on lower sides, upper part of back, and extending on dorsal fin a series of double dark brown spots; adults 120 mm., have vertical bars indistinct and the head, body and fins are profusely covered with small dark brown spots and middle of sides with lengthwise brown streaks___**E. aneitensis** (Günther)

7*b*. Dorsal rays XIII,15 or 16; anal rays II,15 to 17; underside of head with 3 or 4 V-shaped white and dark color marks; no dark shoulder spot.

8*a*. Caudal fin with 4 to 7 narrow dark bars, notably narrower than white interspaces; front of snout plain dusky, except edge of upper lip with traces of several transverse, alternating, very narrow pale and dark streaks; background coloration light brownish to whitish, sides with numerous small dark brown spots characteristically somewhat grouped to correspond with 5 or 6 indistinct vertical bars; most characteristic mark an oblique black dash a little behind eye; head with brownish pigment and usually with numerous small white spots.

9*a*. Anal rays usually, II,17, occasionally II,16; dorsal rays usually XIII,15 or 16, occasionally XIV,15. (Guam; Phoenix and Samoan Islands.)

E. plurifilis plurifilis, new species and subspecies

9*b*. Anal rays usually II,16 or 17; dorsal rays usually XIII,15, often XIII,16. (Marshall Islands.)

E. plurifilis marshallensis, new subspecies

8*b*. Caudal fin with 4 dark bars as broad as or broader than pale interspaces; front of snout, including upper lip, with numerous vertical, narrow, alternating pale and dark streaks; sides plain dusky, without dark spots on a light tan background; characteristic black dash a little distance behind eye; head without white spots.............**E. niuafoouensis** (Fowler)

5*c*. Nuchal flap multicirrate from broad base; orbital tentacle single, edges multicirrate; a dark dash behind eye. (Hawaiian Islands.)

E. marmoratus (Bennett)

TABLE 111.—*Counts on certain species of* Entomacrodus

Species	Fin rays												
	Dorsal							Anal					
	XIII	XIV	13	14	15	16	17	II	15	16	17	18	19
plurifilis plurifilis:													
Phoenix and Samoan Islands	16	1	----	----	6	11	----	17	----	2	15	----	----
Marianas Islands	15	------	----	----	4	11	----	15	----	3	12	----	----
plurifilis marshallensis	35	------	----	----	25	10	----	35	1	18	16	----	----
niuafoouensis [1]	6	------	----	----	2	4	----	6	----	3	3	----	----
incisolabiatus [2]	12	------	----	3	8	1	----	12	----	10	2	----	----
caudofasciatus [3]	14	------	----	2	11	1	----	14	1	12	1	----	----
cymatobiotus	4	------	2	2	----	----	----	4	4	----	----	----	----
decussatus	6	------	----	----	----	----	6	6	----	----	1	3	2
thalassinus [4]	33	------	2	29	2	----	----	32	7	22	3	----	----
aneitensis	11	------	----	----	----	1	10	11	----	----	----	10	1

[1] Niuafoou Island and Guam.
[2] Samoan, Marshall, Marianas Islands.
[3] Swains and Tau Islands.
[4] Phoenix, Samoan, Marshall, Marianas Islands.

ENTOMACRODUS STELLIFER (Jordan and Snyder)

PLATE 115,C

Scartichthys stellifer JORDAN and SNYDER, Proc. U. S. Nat. Mus., vol. 25, p. 461, fig. 10, 1902 (type locality, Wakanoura, Japan).

SPECIMENS STUDIED

Saipan: October 1945, J. R. Simon, 1 specimen, USNM 132845, 39 mm.

Description.—Dorsal rays XIII, 16; anal II, 18; pectoral 14; pelvics I,4; branched caudal probably 5+4; a single, simple orbital and nuchal tentacle on each side; nasal flap single.

Head 3.9; greatest depth 4.3; longest pectoral ray 4.2; snout tip to anus 2.0; anal fin base 2.5; all in standard length. Eye 4.0; snout 2.6; postorbital length of head 1.7; greatest depth of body 1.1; least depth 2.7; longest pectoral ray 1.1; longest dorsal spine 2.3; all in length of head. Fleshy interorbital space 3.1 in eye.

Orbital tentacle, single, simple, somewhat broad at base, tapering to a point, sometimes a single cirrus on inner edge, its length about 1⅔ that of eye diameter; a single, simple, short nuchal cirrus on each side; nasal flap short, broad, without cirri; snout profile with a little forward slant; middle third of edge of upper lip crenulate, the outer thirds smooth; lower lip smooth edged; lateral line arched over pectoral fin, then descending to midlengthwise axis, ending about opposite the middle of length of anal fin base; vertical line through dorsal origin passes through pelvic bases; dorsal fin with a deep notch over last dorsal spine; membrane attaching last dorsal ray to upper edge of caudal peduncle; anal origin under the base of third from last dorsal spine; last anal ray without posterior membrane; pectoral fins reach about to anus; anal spines small, first embedded on females; tips of first anal rays of adult males not swollen; posterior canines minute and scarcely projecting from membrane; teeth fine, numerous, movable, of equal size in both jaws; distal margin of caudal fin rounded; no cephalic crest.

Color in alcohol.—Background coloration light brown, sides with 5 or 6 double dark brown bars; head and body mottled with tiny white or light tan specks and dark specks or short streaks; bases of pectoral similarly marked; orbital tentacle plain dark brown; a blackish spot distally between first and second dorsal spines; dorsal, anal, caudal, and pectoral fins plain light brown to dusky.

ENTOMACRODUS THALASSINUS (Jordan and Seale)

PLATE 115,D,E

Alticus thalassinus JORDAN and SEALE, Bull. U. S. Bur. Fish., vol. 25 (1905), p. 425, fig. 103, 1906 (type locality, Apia, Samoa).

Alticus musilae JORDAN and SEALE, Bull. U. S. Bur. Fish., vol. 25, (1905), p. 425, fig. 104, 1906 (type locality, Apia, Samoa).

SPECIMENS STUDIED

Bikini Atoll: 2 stations, 3 specimens, 16 to 25 mm. in standard length.
Rongerik Atoll: 1 station, 1 specimen, 21 mm.

Eniwetok Atoll: 1 station, 15 specimens, 21 to 31 mm.
Saipan: 1 lot, 1 specimen, 22.5 mm.
Guam: 1 lot, 4 specimens, 27 to 36 mm.

Description.—Dorsal rays XIII, 13 to 15, usually 14; anal II, 15 to 17, usually 16; pectoral 14; pelvics I, 4; branched caudal 5+4 (fewer on small specimens); orbital tentacle single, with 1 to 3 cirri on inner edge, none on outer edge; nuchal tentacle present or absent; nasal cirri 4 to 6.

Head 3.8 to 4.1; greatest depth 4.9 to 5.1; longest pectoral ray 4.5 to 5.0; snout tip to anus 2.2; anal fin base 2.2 to 2.3; all in standard length. Eye 3.9 to 4.4; snout 2.9 to 3.0; postorbital length of head 1.4 to 1.5; greatest depth of body 1.3; least depth 2.8 to 3.0; longest pectoral ray 1.1 to 1.3; longest dorsal spine 1.9 to 2.1; all in length of head. Fleshy interorbital space 2.5 to 2.9 in eye.

Orbital tentacle slender, with 1 to 3 cirri on its inner edge and none on the outer edge; its length about half eye diameter; a single simple short nuchal cirrus on each side, often absent on one or both sides (specimens from the Phoenix and Samoan Islands have a much better developed nuchal cirrus); nasal flap with 4 to 6 short cirri; snout profile rounded or nearly vertical; edges of both lips smooth; lateral line arched over pectoral fin then descending to midlengthwise axis of body and ending about opposite anal origin; vertical line through dorsal origin passes a little behind pelvic bases; dorsal fin with a deep notch over last dorsal spine; a membrane attaching last dorsal ray to upper edge of caudal peduncle; anal origin under base of fourth from last dorsal spine; last anal ray without membrane posteriorly; pectoral fins reaching about to anus; anal spines small, first embedded on females; tips of anal spines of adult males swollen and the first two or three soft rays a little swollen; posterior canines strong on lower jaw; teeth fine, numerous, movable, of equal size in both jaws; distal margin of caudal fin rounded; no cephalic crest.

Color in alcohol.—Background coloration pale to very light tan, with a few small patches along sides composed of some brown pigment cells, or there may be no indication of such pigment on sides, although nearly all the specimens have a small pigmented area about opposite tip of pectoral fin, some times represented by 1 to a few pigment cells; dorsal fin rather finely barred with small dark spots and caudal fin faintly so; anal fin dusky, swollen parts of anal rays of male white, and usually tips of all anal rays white; breast lightly pigmented; a transverse area across under side of head lightly pigmented with dark areas forward and aft unpigmented; a small black spot a little behind eye that is present in all our specimens; there is a tendency for the dark pigment on lower front and lower sides of head to be arranged in several somewhat distinct streaks; in some specimens these pigment cells are arranged to form more or less distinct specks below eye.

Ecology.—This species of blenny was taken on those reefs where the surf was strong. It appeared along the outer edge of the reef when the surf was poisoned with rotenone in the vicinity of the Lithothamnium ridge.

Remarks.—*E. thalassinus* is a small species, the longest specimen seen by us measures about 36 mm. in standard length.

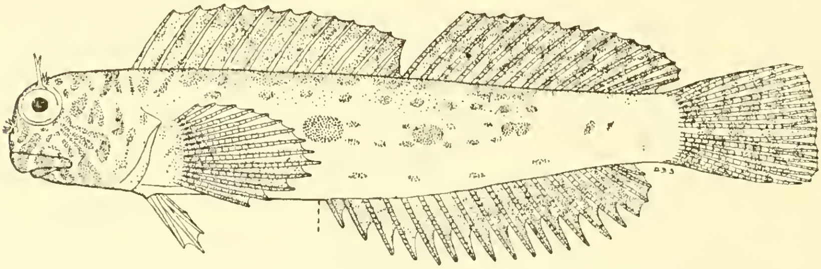

FIGURE 118.—*Entomacrodus incisolabiatus*, new species, holotype, USNM 142188, from Bikini Atoll. Drawn by Dorothea B. Schultz.

ENTOMACRODUS INCISOLABIATUS, new species

FIGURE 118

Holotype.—USNM 142188, Bikini Atoll, Enyu Island, ocean reef and surf, southeast end, August 13, S-46-333, Herald, standard length 45 mm.

Paratypes.—USNM 142189, Bikini Atoll, Namu Island, ocean reef and surf, August 7, S-1019, Brock, Hiatt, and Schultz, 1 specimen, 37 mm.; USNM 111882, Saipan, June 1945, T. D. White and F. B. Shroyer, 1 specimen, 36 mm.; USNM 123934, Guam, Ritidian Point, July 12, 1945, M. H. Markley, 1 specimen, 27 mm.; USNM 111881, Guam, Frey, 1 specimen, 49 mm.; USNM 147654, Swains Island, 1939, Schultz, 1 specimen, 46 mm.; USNM 111883, Tutuila Island, Fagasa Bay, June 5, 1939, Schultz, 7 specimens, 15 to 31 mm.; additional specimen (not a paratype) Bikini Atoll, lagoon light at night, April 23, S-46-111, Schultz and Morrison, 1 specimen 16, mm., in Ophioblennius stage.

Description.—Dorsal rays XIII,14 to 16; anal II,16 or 17, usually 16; pectoral 14, with lower 4 rays enlarged; pelvics I,4; branched caudal 5+4; orbital tentacle single, with 2 to 4 cirri on inner edge and none on outer edge; nuchal cirrus simple; nasal cirri 4 to 7.

Certain measurements were made on the holotype and one paratype from Tutuila Island and these data are recorded in table 112.

Head 3.5 to 4.1; greatest depth 4.2 to 5.1; longest pectoral ray 4.0 to 4.9; snout tip to anus 2.2 to 2.3; anal fin base 2.4 to 2.5; all in standard length. Eye 3.4 to 3.8; snout 2.7 to 2.8; postorbital length of head 1.5 to 1.7; greatest depth of body 1.2 to 1.3; least depth 2.5 to 3.0; longest pectoral ray 1.1 to 1.2; longest dorsal spine 2.0 to 2.1; all in length of head. Fleshy interorbital space 2.5 to 3.0 in eye.

Orbital tentacle slender, simple, with 2 to 4 short cirri on inner edge near base and none on outer edge; orbital tentacle about half to 4/5 diameter of eye in length, a single nuchal cirrus on each side; nasal flap short with about 4 to 7 short cirri; snout profile rounded, with a trifle forward slant; edge of upper lip with the middle third smooth and outer third on each side crenulate; lower lip with smooth edge; lateral line arched over pectoral fin, then descending to midlengthwise axis of body a little in front of tips of pectoral fins, ending over anterior third of anal fin base; vertical line through dorsal origin passes through pelvic bases; dorsal fin with a deep notch over last dorsal spine; membrane behind last soft dorsal ray is attached to upper edge of caudal peduncle; anal origin under base of third or fourth from last dorsal spine; last anal ray without free membrane posteriorly attaching it to caudal peduncle; pectoral fins reaching to anus; anal spines of female small, the first embedded, those of adult males enlarged and convoluted at tips, the next three soft rays also swollen at tips; posterior canines on lower jaw distinct; teeth fine, numerous, movable, of equal size in both jaws; vomer with a row of small blunt teeth; no cephalic crest.

Color in alcohol.—Background coloration whitish or light tan, midsides with about 6 or 7 double spots representing an intensification of faint bars; other evidence of bars is sometimes represented by a row of lightly pigmented areas along lower part of side; the dark pigmented area above and just behind the pectoral base and below lateral line is no more intense than other dark spots along midside of body; oblong white spots, or short lengthwise white streaks, occur on some specimens, these arranged in rows along sides, one row just below midlengthwise axis and another along lower side, other small white spots occur but are not arranged in definite rows; the holotype lacks these white spots since it is somewhat faded, dorsal and anal fins dusky, with a transverse row of white spots about halfway out on both fins (another row of white spots at base of anal fin on one paratype); caudal fin barred with dusky; head a little dusky, with 7 narrow pale or white lines from front of snout and below eyes, crossing upper lip, one of these median at front of snout, and 3 on each side, a fourth one occurs on each side just behind corner of mouth, all these (except the median one) continue on under side of head, obliquely extending toward each other but not quite meeting at midventral line of head; no definite dark blotch behind eye; usually several dark spots evident through abdominal wall opposite intestines.

Remarks.—This species is most closely related to *E. caudofasciatus* (Regan) but may be distinguished from that species by lacking the greatly intensified dark spot just above and behind pectoral fin base.

ENTOMACRODUS DECUSSATUS (Bleeker)

Plate 116,F,G

Salarias decussatus Bleeker, Nat. Tijdschr. Nederl.-Indië, vol. 15, p. 230, 1858 (type locality, Western Biliton and Sangi Islands; in sea).

SPECIMENS STUDIED

Guam: Nov. 26, 1945, Frey, 6 specimens, 72 to 132 mm. in standard length.

Description.—Dorsal rays XIII,17; anal II,17 to 19 usually II,18 or 19; pectoral 14, with lower 5 or 6 rays swollen; branched caudal 5+4; pelvics I,4; orbital tentacle single with cirrate edges; nuchal flap single or with an extra cirrus basally; nasal cirri about 5 to 7.

Head 3.7 to 4.0; greatest depth 4.0 to 4.2; longest pectoral ray 4.3 to 4.5; snout tip to anus 1.9 to 2.0; anal fin base 2.4 to 2.6; all in standard length. Eye 4.5 to 5.2; snout 2.7 to 2.8; postorbital length of head 1.6; greatest depth of body 1.0 to 1.1; least depth 2.2 to 2.5; longest pectoral ray 1.1; longest dorsal spine 2.2 to 2.5; all in length of head. Fleshy interorbital space 1.7 to 2.1 in eye.

Orbital tentacle single, thin, but broad at the base, tapering to a point distally, its edges with numerous cirri, and its length from ⅔ to ⅘ eye diameter; nuchal dermal flap usually single, broad at base but thin, rapidly tapering to a point, its edges with one to a few short cirri (especially on adults), its length about equal to pupil diameter; nasal flap, palmate, with pedunculate base, then a broad thin flap, with several cirri distally; snout profile rounded, with a slight forward slant from the vertical; edge of upper lip a little crenulate, that of lower lip smooth; lateral line abruptly arched over pectoral fin, then following a course along midlengthwise axis of body, ending over rear part of anal fin base; vertical line through dorsal origin passes just behind pelvic bases; dorsal fin with a moderately deep notch over last dorsal spine; a membrane attaches last dorsal ray to caudal peduncle as far back as base of caudal fin; anal origin about under bases of second or third from last dorsal spines; last anal ray without membrane posteriorly; pectoral fins not quite reaching to anus; anal spines small, embedded on females, first anal rays of adult males not swollen at tips; posterior canine in each side of lower jaw small, projecting laterally into mouth cavity; teeth fine, numerous, movable, of equal size in both jaws; vomer with a transverse series of short conical teeth; no cephalic crest.

Color in alcohol.—Background color light gray to light tan, head and body profusely blotched with dark brown, this darker pigmentation arranged to form 6 double but highly irregular vertical bars; dorsal, anal, caudal, and pectoral fins barred with dark brown or blackish; pectoral base with a brownish bar, then a whitish bar posteriorly on its base; a dusky bar below eye; pelvics white.

TABLE 112.—*Certain measurements on species of* Entomacrodus, *recorded in thousandths of the standard length*

Characters	*incisolabiatus*		*plurifilis plurifilis*		*plurifilis marshallensis*		*cymatobiotus*	
	Holotype	Paratype	Holotype	Paratype	Holotype	Paratype	Holotype	Paratype
Standard length in mm	45	31.4	60.5	61.3	65.5	57	26.2	27.5
Length of head	240	267	255	253	219	255	263	265
Greatest depth	188	197	189	204	175	209	199	200
Least depth of body	96	83	99	101	102	91	92	87
Postorbital length of head	142	153	165	168	159	153	153	160
Diameter of eye	56	57	55	57	49	63	73	69
Snout	89	102	94	91	102	95	88	102
Interorbital space (fleshy)	18	16	20	18	17	18	23	22
Length of orbital cirrus	58	38	35	44	63	44	53	40
Longest dorsal spine	111	118	99	106	111	107	115	138
Longest soft dorsal ray	142	127	150	144	143	140	153	175
Longest anal ray	115	105	116	135	134	114	118	95
Longest pectoral ray	205	261	205	212	212	237	237	225
Longest pelvic ray	131	181	127	131	133	144	145	145
Longest caudal ray	211	235	222	240	237	251	210	218
Snout tip to anus	444	446	462	456	450	504	500	510
Snout tip to dorsal origin	218	255	215	217	224	233	256	262
Length of anal fin base	418	385	426	434	423	365	382	392

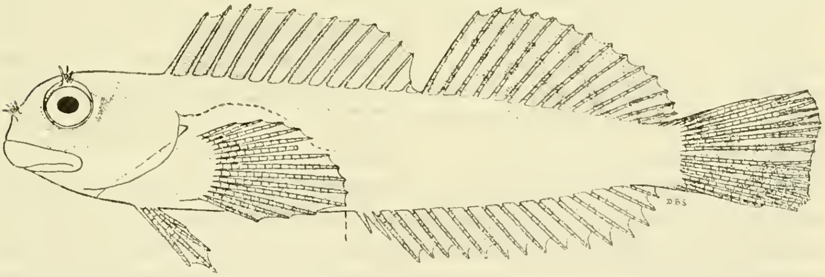

FIGURE 119.—*Entomacrodus cymatobiotus*, new species, holotype, USNM 142183, from Bikini Atoll. Drawn by Dorothea B. Schultz.

ENTOMACRODUS CYMATOBIOTUS, new species

FIGURE 119

Holotype.—USNM 142183, Bikini Atoll, Eman Island, ocean reef in surf, July 19, 1947, S-46-441, Schultz, Brock, Myers, and Hiatt, standard length 26.2 mm., adult male.

Paratypes.—USNM 142182, Eniwetok Atoll, Mui Island, ocean reef in surf, May 28, S–46–186, Schultz, 4 specimens, 23 to 27 mm., 3 males and 1 female.

Description.—Dorsal rays XIII,13 or 14; anal II,15; pectoral 14; branched caudal normally 5+4; pelvics I,4; orbital cirri 3 to 5; nuchal cirrus simple, single, on each side; nasal cirri 4 to 6.

Certain measurements were made on the holotype and one female paratype from Eniwetok Atoll, and these data are recorded in table 112.

Head 3.7 to 3.8; greatest depth 4.5 to 4.7; longest pectoral ray 4.2 to 4.4; snout tip to anus 2.0; anal fin base 2.6 to 2.7; all in standard length. Eye 3.8 to 4.0; snout 2.9 to 3.0; postorbital length of head 1.7; greatest depth of body 1.3; least depth 2.4 to 2.8; longest pectoral ray 1.2; longest dorsal spine 2.1 to 2.2; all in length of head. Fleshy interorbital space 2.9 to 3.0 in eye.

Orbital tentacle consisting of 3 to 5, slender, simple cirri arising from a common base, the outer cirrus usually longest, its length about ⅔ eye diameter; nuchal cirrus simple, single on each side; nasal cirri 4 to 6; snout profile rounded, with a forward slant from the vertical of about 10 to 15 degrees; edge of upper lip crenulate, that of lower lip smooth; lateral line arched over pectoral fin, then descending to midlengthwise axis of body and ending about opposite anal fin origin; vertical line through dorsal origin passes a little behind pelvic base; dorsal fin with a deep notch over last dorsal spine; membrane behind last soft dorsal ray attached to upper edge of caudal peduncle; anal origin under base of third or fourth from last dorsal spine; last anal ray without free membrane posteriorly; pectoral fins reaching to anus; anal spines of female small, first embedded, those of adult males with enlarged swollen tips, followed by 2 or 3 more with swollen tips; posterior canines on lower jaw distinct; teeth fine, numerous, movable, of equal size in both jaws; vomer with a row of small blunt teeth; caudal fin truncate distally; no cephalic crest.

Color in alcohol.—Background coloration light tan, with traces of some tiny patches of dark pigment cells dorsally; pectoral fin lightly covered with black pigment cells; dorsal fin dusky, with distal edge or tips of rays white; soft dorsal with some dark specks; anal fin dusky; side of head with 3 lightly pigmented dark spots arranged to form bars; caudal fin barred with lightly pigmented dark streaks, first close behind eye has an intensification of pigment to form a spot just behind eye, then a white streak followed by a dark streak, then a white streak followed by a thin line of dark pigment cells across opercle, all three darkened streaks end ventrally about opposite mouth; base of pectoral with an unpigmented central area, the adjoining area lightly black pigmented.

Ecology.—This species was taken with *E. thalassinus* in the surf along the outer edge of the ocean reefs.

Remarks.—This new species is closest to *E. thalassinus*, but differs in having the edge of the upper lip crenulate and in having 3 narrow dark streaks across side of head, with a dusky spot behind eye in the first dark streak; the orbital tentacle branches from the base, whereas the upper lip of *thalassinus* is smooth edged, the side of the head is plain light dusky with a black spot just behind the eye, and the orbital tentacle has cirri arising on the inner side of the dermal tentacle.

ENTOMACRODUS ANEITENSIS (Günther)

PLATES 114,C; 116,H

Salarias aneitensis GÜNTHER, Journ. Mus. Godeffroy, vol. 4, pt. 13, p. 205, pl. 118, fig. A, 1877 (type locality, Aneiteum Island).

SPECIMENS STUDIED

Guam: 13 specimens, 16 to 67 mm., Markley and Johnson.
Saipan: 2 specimens, 34 mm., June 1945, White and Shroyer.

Description.—Dorsal rays XIII,17, rarely XIII,16; anal II,18, rarely II,19; pectoral 14, with lower 5 rays enlarged; branched caudal 5+4; pelvics I,4; orbital flap single, both outer and inner edges with from 1 to several cirri, the number appearing to increase with the size; a single simple nuchal cirrus on each side; nasal flap with 3 to 7 short cirri.

Head 3.6 to 3.8; greatest depth 4.0 to 4.3; longest pectoral ray 4.0 to 4.4; snout tip to anus 2.0; anal fin base 2.4 to 2.5; all in standard length. Eye 3.1 to 4.2; snout 2.4; postorbital length of head 1.8; greatest depth of body 1.1 to 1.2; least depth 2.7 to 3.0; longest pectoral ray 1.2 to 1.3; longest dorsal spine 2.2 to 2.3; all in length of head. Fleshy interorbital space 2.2 to 2.5 in eye.

Orbital tentacle thin, rather broad at base, tapering to a point, edges with from 1 to 7 short cirri, number increasing with size of specimen; length of orbital tentacle from half of to same as eye diameter; a single, simple nuchal cirrus on each side; nasal flap with 3 to 7 short cirri; snout profile rounded, with a little forward slant; edge of upper lip weakly crenulate, more obvious in middle third than outer thirds; lower lip smooth edged; lateral line arched over pectoral fin, then descending to midlengthwise axis of body, ending about opposite middle of anal fin base; vertical line through dorsal origin passes through pelvic bases; dorsal fin with a deep notch over last dorsal spine; membrane behind last soft dorsal ray is attached to upper edge of caudal peduncle; anal origin under base of third from last dorsal spine; last anal ray without membrane posteriorly; pectoral fins reach to anus; anal spines of female small, the first embedded, those of adult males not notably swollen at tips; posterior canines on lower jaw distinct; teeth fine, numerous, movable, of equal size in both jaws; vomer with a row of small blunt teeth; no cephalic crest.

Color in alcohol.—Background color light tan, with the vertical bars represented by dark brown markings on specimens as long as 65 mm. in standard length, as follows: Along midside a series of pale-centered dark brown spots, anterior and posterior ones sometimes not pale centered; lower side with a series of double dark brown spots; on upper part of back and extending onto dorsal fin a series of double dark brown spots. Dorsal, anal, caudal, and pectoral fins barred with dark brown; usually a small more or less distinct dark brown spot on upper part of opercle. Large adults 120 mm. in standard length have a somewhat different color pattern: The vertical bars are practically indistinct, being replaced by numerous scattered small dark brown spots on head and body, and fins; the sides have lengthwise brown streaks.

Remarks.—This species is recognizable because of its light tan background on which is a sharply defined pattern of dark brown blotches or spots.

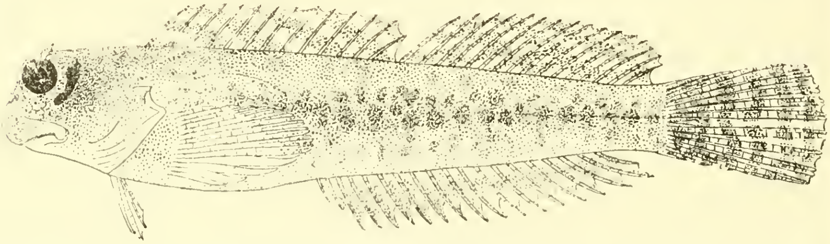

FIGURE 120.—*Entomacrodus plurifilis plurifilis*, new species and new subspecies, holotype' USNM 144720, from Tau Island. Drawn by A. M. Awl.

ENTOMACRODUS PLURIFILIS PLURIFILIS, new species and new subspecies

FIGURE 120

Salarias marmoratus (not of Bennett) SCHULTZ, U. S. Nat. Mus. Bull. 180, p. 283, 1943 (Phoenix and Samoan Islands).

Holotype.—USNM 144720, Samoan group, Tau Island, reef at Siulagi Point, June 27, 1939, Schultz, standard length 60.5 mm.

Paratypes.—USNM 115456, Tutuila Island, Fagasa Bay, 1939, Schultz, 5 specimens, 21.5 to 54 mm.; USNM 115457, Tutuila Island, Alofau reef, 1939, Schultz, 3 specimens, 47 to 54 mm.; USNM 115459, Tutuila Island, reef at entrance Pago Pago Bay, 1939, Schultz, 4 specimens, 40 to 47 mm.; USNM 52264, Samoa, Jordan and Kellogg, 1 specimen, 59 mm.; USNM 115450, Swains Island, 1939, Schultz, 13 specimens, 32 to 64 mm.; USNM 115452, Tau Island, Siulagi Point, 1939, Schultz, 104 specimens, 22 to 73 mm.; USNM 115453, Canton Island, ocean reef, 1939, Schultz, 27 specimens, 23 to 60 mm.; USNM 115448, Canton Island, channel, 1939, Schultz, 1 specimen, 47 mm.; USNM 115451, Canton Island, lagoon, 1939, Schultz, 3 specimens; USNM 115455, Canton Island, channel, 1939, Schultz, 3 specimens, 41 to 49 mm.; USNM 124347, Rose Island, 1939, Schultz, 1 specimen, 21 mm.; USNM 115458, Rose Island, 1939, Schultz, 5 specimens, 36 to 48 mm.; USNM 115454, Hull Island, channel, 1939, Schultz, 5 specimens, 22 to 45 mm.; USNM 115449, Enderbury Island, reef, 1939, Schultz, 20 specimens, 38 to 73 mm.

The following specimens from the Marianas Islands are identified as this species but are not considered as paratypes: Guam, Apra Bay, Nov. 19–21, 1907, *Albatross*, 1 specimen, 62 mm.; Guam, Oca Point, June 26, 1945, McElroy and Markley, 1 specimen, 39 mm.; Guam, Nov. 25, 1945, Frey, 20 specimens, 18 to 54 mm.; Tinian Island, July 10, 1945, Eugene Cypert, 4 specimens, 38 to 59 mm.; Saipan, June 1945, White and Schroyer, 6 specimens, 47 to 60 mm.

Description.—Counts made on the holotype and one paratype are respectively: Dorsal rays XIII,16; XIII,16; anal II,17; II,17; pectoral always 14 with lower 5 rays enlarged; branched caudal 5+4; and pelvics I,4. Orbital tentacle single with 4 to 8 cirri on inner edge and 2 to 4 on outer edge; a single nuchal cirrus on each side; nasal flap with 6–6 and 6–7 cirri. Measurements made on the holotype and one paratype are recorded in table 112.

Head 3.6 to 4.2; greatest depth 4.8 to 5.2; longest pectoral ray 3.9 to 4.7; snout tip to anus 2.0 to 2.3; anal fin base 2.3 to 2.4; all in standard length. Eye 3.5 to 4.9; snout 2.5 to 2.8; postorbital length of head 1.5 to 1.6; greatest depth of body 1.3 to 1.4; least depth 2.4 to 3.0; longest pectoral ray 1.1 to 1.2; longest dorsal spine 2.0 to 2.6; all in length of head. Fleshy interorbital space 2.3 to 2.5 in eye.

Orbital tentacle single, thin, broad based, tapering to a point, with several cirri on inner edge but usually about 2 or 3, or occasionally 4 small cirri on outer edge; length of orbital tentacle from half of to equal to diameter of eye; a single nuchal cirrus on each side; nasal flap short, with several cirri; snout profile rounded but with a slight forward slant of about 10 degrees from the vertical; edge of upper lip crenulate, that of lower lip smooth; lateral line arched over pectoral fin then continuing along midlengthwise axis and ending over middle third of length of anal fin base; vertical line through dorsal origin passes through pelvic fin bases; dorsal fin with a deep notch over last spine; membrane behind last soft dorsal ray attached to upper edge of caudal peduncle but not to caudal fin; anal origin under base of fourth from last dorsal spine; last anal ray without membrane attaching it to caudal peduncle; pectoral fins reach to or nearly to anus; anal spines of female small, the first completely embedded, the second small, those of males distinct; first 5 or 6 anal rays of adult males a little swollen at tips; posterior canines on lower jaw distinct; teeth fine, numerous, movable, of equal size in both jaws; vomer with a row of small blunt teeth; cephalic crest undeveloped.

Color in alcohol.—Background coloration light brownish to whitish, sides with small dark brown spots, usually characteristically somewhat grouped to correspond with the 5 or 6 indistinct vertical bars; ventrally plain whitish to light brown, sometimes a few patches of tiny pigment spots to correspond with the vertical bars; dorsal and caudal fins barred with black spots; anal fin dusky distally, some dark spots ventrally; pectoral and pelvic fins unspotted; the most characteristic mark is an oblique black dash a little distance behind the eye; head with brownish pigment and sometimes with numerous small white spots; brown pigment below eye sometimes intensified and indicating a short bar; no dark shoulder spot; underside of head with 3 pairs of white streaks, the middle pair V-shaped. Peritoneum dusky dorsally, paler ventrally.

Ecology.—This common reef species occupied the flat areas on the reefs and was often taken in shallow tidal pools.

Remarks.—*Entomacrodus plurifilis* is related to *Salarias frenatus* Cuvier and Valenciennes, *Salarias striatus* Quoy and Gaimard, *Salarias arenatus* Bleeker, but differs from them in having short cirri on the outer edge of the orbital tentacle or in lacking the black spot above axil of pectoral. *Entomacrodus marmoratus* (Bennett) of the Hawaiian Islands differs from *plurifilis* and the other three species in having multicirrate nuchal dermal flaps.

E. plurifilis is most closely related to *E. niuafoouensis* (Fowler), but differs, as indicated in the key, mostly in lacking blackish spots on sides and in lacking numerous narrow alternating vertical dark and pale streaks on front of snout. We have ruled out the possibility that *plurifilis* is the young stage of *niuafoouensis* on the grounds that *plurifilis* is mature at smaller size and, in addition, the dark bars on the caudal fin are narrower than the pale interspaces, whereas in *niuafoouensis* they are as wide or wider.

Named *plurifilis* in reference to the cirri on outer edge of orbital tentacle.

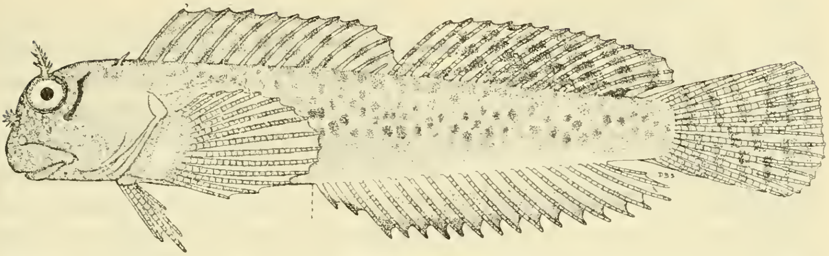

FIGURE 121.—*Entomacrodus plurifilis marshallensis*, new subspecies, holotype, USNM 142155, from Bikini Atoll. Drawn by Dorothea B. Schultz.

ENTOMACRODUS PLURIFILIS MARSHALLENSIS, new subspecies

FIGURE 121

Holotype.—USNM 142155, Bikini Atoll, Enyu Island, reef at entrance of channel, March 16, S–46–8, Schultz, Brock and Marr, standard length 65.5 mm.

Paratypes.—USNM 142156, Bikini Atoll, Enyu Island, entrance to reef, March 16, S–46–8, Schultz, Brock and Marr, 29 specimens, 18 to 65 mm.; USNM 142157, Bikini Atoll, Erik Island, March 19, S–46–9, Schultz and Brock, 4 specimens, 33 to 43 mm.; USNM 142167, Bikini Atoll, Romuk Island, lagoon, April 2, S–46–48, Schultz, 21 specimens, 20 to 67 mm.; USNM 142159, Bikini Atoll, Namu Island, tidal pool, April 3, S–46–49, Schultz, 1 specimen, 41.5 mm.; USNM 142160, Bikini Atoll, Namu Island, ocean reef, April 4, S–46–51, Schultz, 1 specimen, 28 mm.; USNM 142162, Bikini Atoll, Cherry Island, high tidal pools, April 8, S–46–99, Schultz, 45 specimens, 15 to 64 mm.; USNM 142161, Bikini Atoll, Romuk Island, May 14, S–46–128, Schultz, 3 specimens, 26 to 45 mm.; USNM 142166, Bikini Atoll, Reer Island, lagoon reef, Aug. 12, S–46–332, Herald and Brock, 113 specimens, 18 to 63 mm.; USNM 142164, Bikini Atoll, Enyu Island, ocean reef, August 13, S–46–333, Herald, 3 specimens, 53 to 55 mm.; USNM 142163, Bikini Atoll, Cherry Island, ocean reef, August 15, S–46–361, Herald, 3 specimens, 21 to 56 mm.; USNM 142165, Bikini Atoll, Oruk Island, ocean reef, August 16, S–46–382, Herald, 5 specimens, 29 to 58 mm.; USNM 142158, Bikini Atoll, Boby Island, ocean reef, August 17, S–46–383, Herald, 1 specimen, 48 mm.; USNM 142171, Bikini Atoll, tidal pond between Eman and Reer Islands, ocean reef, July 18, 1947, S–46–422, Brock, Hiatt, Schultz, and Myers, 3 specimens, 24 to 50 mm.; USNM 142170, Bikini

Atoll, Enyu Island, channel reef, August 1, 1947, S–46–483, Schultz, Brock, and Hiatt, 1 specimen, 42 mm.; USNM 142168, Bikini Atoll, Bikini Island, western tip, August 18, 1947, S–42–533, Brock and Schultz, 2 specimens, 35 to 67 mm.; USNM 142169, Bikini Atoll, Namu Island, ocean reef, August 7, 1947, S–1019, Brock, Hiatt, and Schultz, 1 specimen, 19 mm.; USNM 142178, Eniwetok Atoll, Eniwetok Island, ocean surf, May 20, S–46–159, Schultz, 8 specimens, 46 to 63 mm.; USNM 142181, Eniwetok Atoll, Mui Island, ocean reef, May 28, S–46–186, Schultz, 1 specimen, 20 mm.; USNM 142180, Eniwetok Atoll, Rigili Island, lagoon reef, May 30, S–46–189, Schultz, 5 specimens, 49 to 82 mm.; USNM 142179, Eniwetok Atoll, Aaraanbiru Island, ocean reef, June 3, S–46–198, Schultz, 13 specimens, 32 to 56 mm.; USNM 142177, Rongerik Atoll, Bock Island, ocean reef, April 24, S–46–113, Brock and Marr, 12 specimens, 23 to 71 mm.; USNM 142176, Rongerik Atoll, Bock Island, ocean reef, June 27, S–46–237, Schultz and Herald, 6 specimens, 32 to 56 mm.; USNM 142174, Rongelap Atoll, Arbor Island, June 16, S–46–214, Schultz, 39 specimens, 16 to 58 mm.; USNM 142175, Rongelap Atoll, Enybarbar Island, ocean reef, June 18, S–46–216, Schultz, 178 specimens, 23 to 83 mm.; USNM 142173, Rongelap Atoll, Tufa Island, ocean reef, July 18, S–46–260, Herald and Brock, 5 specimens, 22 to 53 mm.; USNM 142172, Kwajalein Atoll, Ennylabegan Island, lagoon reef, Sept. 1, S–46–397, Herald, 2 specimens, 40.5 to 42.5 mm.

Description.—Counts made on the holotype and one paratype are, respectively: Dorsal rays XIII,15; XIII,15; anal II,16; II,16; pectoral always 14 with lower 5 rays thickened or enlarged; branched caudal 5+4; and pelvics I,4. Orbital tentacle single, with 3 to 6 cirri on inner edge and 1 to 3 on outer edge, except sometimes no cirri are developed in young 25 mm. or shorter; a single nuchal cirrus on each side; nasal flap with 6–8 and 6–6 cirri.

Head 3.8 to 4.2; greatest depth 5.0 to 5.2; longest pectoral ray 4.3 to 4.7; snout tip to anus 2.2; anal fin base 2.3 to 2.4; all in standard length. Eye 3.5 to 5.0; snout 2.5 to 3.0; postorbital length of head 1.6 to 1.7; greatest depth of body 1.3 to 1.4; least depth 2.5 to 3.1; longest pectoral ray 1.0 to 1.2; longest dorsal spine 2.2 to 2.3; all in length of head. Fleshy interorbital space 2.2 to 2.5 in eye.

The characters of *Entomacrodus plurifilis marshallensis*, except for the number of soft rays in dorsal and anal fins, are the same as for *E. p. plurifilis* and need not be repeated here. Table 112 gives the counts made for both subspecies, and an examination of that data indicates a distinct population in the Marshall Islands. About 71 percent of the specimens of *E. p. marshallensis* have 15 soft dorsal rays and about 51 percent 16 soft anal rays whereas *E. p. plurifilis*, respectively, have 70 percent with 16 soft dorsal and 83⅓ percent with 17 soft anal rays.

Color in alcohol.—No significant coloration differences exist between the two subspecies, *plurifilis* and *marshallensis.*

Ecology.—This common species occurred in the shallow parts of both the lagoon and ocean reefs and in the isolated shallow tidal pools near the high tidal pools and channels just below high tidal level. It was more abundant where crevices and small coral growth offered protection.

Remarks.—This new subspecies differs from *E. p. plurifilis* in having a lower number of both soft dorsal and anal rays.

Named *marshallensis* in reference to the Island group in which it occurs.

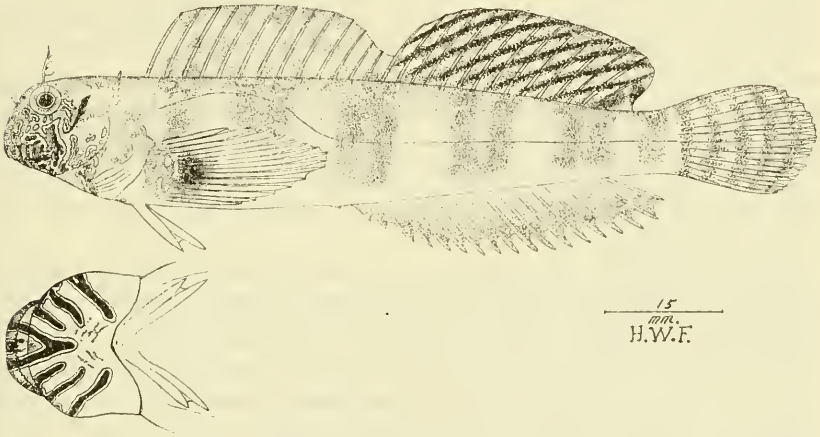

FIGURE 122.—*Entomacrodus niuafoouensis* (Fowler), holotype, USNM 91932, after Fowler.

ENTOMACRODUS NIUAFOOUENSIS (Fowler)

PLATE 114,D; FIGURE 122

Salarias niuafoouensis FOWLER, Proc. U. S. Nat. Mus., vol. 81, art. 8, p. 7, fig. 3, 1932 (type locality, Niuafoou Island, Tonga group; holotype USNM 91932 and paratype USNM 138298).

Salarias lacunicola FOWLER, Proc. Acad. Nat. Sci. Philadelphia, vol. 98, p. 178, figs. 41a, 42, 1946 (type locality, Riu Kiu Islands).

SPECIMEN STUDIED

Guam: Ypao Point, 1 female specimen, 57 mm., D. H. Johnson.

Description.—Dorsal XIII,15; anal II,16; pectoral 14, branched caudal 5+4; pelvics I,4; orbital tentacle single on each eye, both with 4 cirri on inner edge and 1 cirrus on outer edge; nuchal cirrus simple on each side; nasal flap with 8 cirri.

Head 3.8, depth 4.4; longest pectoral ray 4.1; snout tip to anus 2.1; anal fin base 2.5; all in standard length. Eye 4.4; snout 2.7; postorbital length of head 1.7; greatest depth of body 1.1; least depth 3.1; longest pectoral ray 1.2; longest dorsal spine 2.3; all in length of head. Fleshy interorbital space 2.2 in eye.

Orbital tentacle as long as diameter of eye, single, with 4 cirri on inner edge, 1 cirrus on outer edge basally and tapering to a point; nuchal cirrus simple, single, on each side; nasal flap with about 8 cirri distally; snout profile with a little forward slant; entire edge of upper lip crenulate, that of lower lip smooth; lateral line arched over pectoral fin, descending to midlengthwise axis, then continuing posteriorly and ending about opposite middle of length of anal fin base; vertical line through dorsal origin passes a trifle behind pelvic fin base; dorsal fin with a deep notch over last dorsal spine; membrane behind last soft dorsal ray attached to upper edge of caudal peduncle; anal origin under base of third or fourth from last dorsal spine; last anal ray without membrane posteriorly; pectoral fins reaching about to anus; anal spines of female small, the first embedded, those of male distinct, without swollen tips on adults; posterior canines on lower jaw distinct but small; teeth fine, numerous, movable, of equal size in both jaws, vomer with a row of small blunt teeth; no cephalic crest.

Color in alcohol.—Background coloration plain light brown with scarcely any trace of vertical bars; no dark spots in middle of sides; a black dash a short distance behind eye, separated from eye by a whitish area; dorsal fin barred with darker; caudal fin with 4 dark bars as wide as or a little wider than paler interspaces; anal dusky, with tips of rays white; pectoral with a slight trace of dusky bars ventrally; underside of head with 3 or 4 V-shaped alternating light and dark bars, the dark bars outlined by a white line, which is bordered by a narrow line of dark pigment cells.

Remarks.—*E. plurifilis* and *E. niuafoouensis* are very closely related; they are distinguishable by minor differences in their color pattern. We have considered the possibility that *plurifilis* represents the younger stage of *niuafoouensis*, but since numerous specimens of *plurifilis* are mature adults (females with large eggs) we conclude they are not.

Genus ISTIBLENNIUS Whitley

Istiblennius Whitley, Australian Zool., vol. 10, p. 185, 1943 (type species, *Salarias mulleri* Klunzinger).

Fowler (Proc. Acad. Nat. Sci. Philadelphia, vol. 98, p. 177, fig. 41, 1946) described *Salarias brevoorti* from the Ryukyu Islands; an examination of the holotype, a female, shows that it is a synonym of *Istiblennius bilitonensis* (Bleeker 1858).

See table 113 for counts recorded for the various species in this genus.

KEY TO THE SPECIES OF ISTIBLENNIUS AND SALARIAS FROM THE MARSHALL AND MARIANAS ISLANDS

1*a*. Dorsal rays XIII (rarely XIV), 22 to 25; anal rays II,23 to 25; nuchal tentacle absent; lower jaw without posterior canines; edge of upper lip crenulate, that of lower lip smooth; orbital tentacle simple, thin, and broad but with cirri on its edges; sides with distinct dark brown to blackish lengthwise lines, or they may be indistinct but always there are traces of these lines on caudal peduncle in the form of many black specks, except occasionally in young specimens shorter than 30 mm. **I. lineatus** (Cuvier and Valenciennes)

1*b*. Dorsal soft rays fewer than 22, soft anal rays fewer than 23 (or rarely 23); edge of lower lip smooth.

2*a*. Edge of upper lip crenulate; nuchal tentacle usually present, minute, sometimes absent on one or both sides; posterior canine present on each side of lower jaw.

3*a*. Orbital tentacle present, slender, simple, length about equal to eye diameter, or a little less; nuchal cirrus simple, always present; background coloration dark brown to light tan, sides with 7 dark bars, each double ventrally, sometimes the dark bars are represented by 4 oblong dark spots on sides; a small dark opercular spot or silvery blue spot with black margins, and a pale oblique streak behind eye margined posteriorly with a dusky line is usually distinct; on middle of sides in the dark bars are 5 or 6 pairs of bright silvery to bluish white spots bordered by a black line__ **I. paulus** (Bryan and Herre)

3*b*. Orbital tentacle slender, but notably broader than thick, its tip with 2 to 4 cirri, and its length not quite equal to diameter of eye; nuchal cirrus very small, threadlike, usually present, occasionally present on only one side, or absent on both sides; background coloration of females pale tan, with traces of about 9 double bars, usually represented by a few tiny spots or short vertical dark lines so arranged that the upper two spots are a little above the midsides and the lower pair are on lower part of sides, tip of each dorsal spine black; background coloration of males light tan to brown usually with a purplish tinge ventrally; a conspicuous purplish black spot, size of pupil to half eye diameter, on middle of side opposite base of about second soft dorsal ray; tip of dorsal spines black; white spots on dorsal surface of head as in females; usually a dark spot just behind eye ________________________________ **I. coronatus** (Günther)

2*b*. Edge of upper lip smooth.

4*a*. No posterior canines on lower jaw; nuchal cirrus present.

5*a*. Orbital tentacle single, simple, thin, much broader than thick, wider basally, tapering to a point distally, its length ½ to ¾ eye diameter, and occasionally in adults 1 or 2 cirri, branching off the edge near the tip; nuchal cirrus on each side of nape, single, thin, much broader than thick basally, tapering to a point; a distinct notch in dorsal fin over last dorsal spine; dorsal rays XII (rarely) or XIII,19 to 21; anal II,20 to 23, rarely 23; background coloration of females brown to pale tan, with or without 6 or 7 more or less double dark bars on sides; posterior part of body and dorsal fin finely speckled with dark brown specks or dots; background coloration of males brownish or light brownish, with or without 6 or 7 darker double bars; dorsal fin dusky distally with lengthwise narrow pale or whitish streaks; cephalic crest blackish; side of head sometimes with irregular pale markings; greatest depth 4.5 to 5.0, head 3.5 to 4.4, both in standard length.

I. edentulus (Bloch and Schneider)

5*b*. Orbital tentacle composed of 1 to 3 (usually 1 in young) cirri branching from base, their length ⅔ to ¾ eye diameter; nuchal dermal flap broad and thin, with numerous cirri on its edges; dorsal fin without notable notch over last dorsal spine; dorsal rays about XII,19; anal II,19 or 20; background coloration light brown to brown, with 8 vertical, double, dark brown bars more or less connected, ending dorsally and ventrally at bases of median fins to form double dark spots; anterior part of body with round whitish spots from size of pupil to that of eye and with numerous lengthwise, short, parallel black lines more widely spaced on lower sides; anteriorly above pectoral fin, body and spiny dorsal finely spotted with black dots; underside of head with two transverse broad dark brown bands, edge of gill membrane brown; a broad transverse dark brown band through pelvic base and one across abdomen between pectoral bases, another about equidistant between pelvic bases and anal origin; greatest depth 3.5 to 4.5; head 3.2, to 4.2, in standard length. **S. fasciatus** (Bloch)

4*b*. Posterior canine on each side of lower jaw; orbital tentacle simple, single; nuchal cirrus present or absent; anal rays II,19 to 21; dorsal rays XIII,18 to 20.

6*a*. No dark spot on dorsal membrane between first 2 spines; nuchal cirrus absent; background coloration of males plain light brownish to tan on body and head, with dorsal, anal, and caudal fins dusky to blackish, sides sometimes with 7 or 8 vertical darkish bars and sometimes with traces of 2 short lengthwise dark lines about opposite tip of pectoral fin, a very small dark spot just behind eye and opposite its upper edge, another behind lower rear edge of eye (both spots may be pale-centered with dark edges), and another on upper part of opercle; background coloration of females light tan, with 4 lengthwise black lines on sides beginning about opposite tip of pectoral fin, these breaking up into black dots posteriorly, the upper 3 lines are on midsides and evenly spaced, the fourth and ventralmost more widely spaced, dorsal and anal fins barred with small black spots.

I. cyanostigma (Bleeker)

6*b*. Coloration not as above; a black spot on membrane between first 2 dorsal spines.

7*a*. Dorsal soft rays 19 or 20, usually 20; anal soft rays 20 or 21, usually 21 (see table for counts), nuchal cirrus absent; female coloration consists of distinctly reticulated dark lines and about 8 vertical bars usually in the form of double lines, most distinct on lower sides, underside of head evenly pigmented or with numerous small dark spots but with no transverse dark bars, dorsal and caudal fins speckled with black, front edge of lower lip dark brown; males with sides of body plain brownish, some traces of dark specks on head, and spiny dorsal fin with dark blotches between spines on distal half. (Hawaiian Islands, abundant in tidal pools.)

I. gibbifrons Quoy and Gaimard

7*b*. Dorsal soft rays 18 to 20, usually 19, rarely 20; anal 19 or 20; usually 20, rarely 21.

8*a*. Females with no dark reticulated lines on lower part of sides, distinct vertical double dusky lines representing dark vertical bars on sides, 2 or 3 transverse light brown bars on underside of head, the third next to rear edge of gill membrane and interrupted near midventral line, anterior 2 sometimes joined at midventral line or interrupted, front edge of lower lip dark brown; males with sides light tan with light brownish spots, these more distinct on head and becoming diffuse posteriorly, in outer ⅗ of spiny dorsal fin with dark streak composed of dark blotches. (Phoenix Islands, Swains Island.) -------------------- **I. afilinuchalis**, new species

8*b*. Females with no dark reticulated lines, vertical bars represented by a series of faint double spots only along ventral side of body near anal fin base, underside of head diffusely pigmented, rarely with traces of dark pigment spots and no dark bars, front edge of lower lip slightly darker than underside of head but pigment diffuse; males with sides light tan with light brown spots, these most distinct on head and becoming diffuse posteriorly, spiny dorsal fin with small dark spots somewhat arranged in rows. (Northern Marshall Islands.)

I. rodenbaughi, new species

TABLE 113.—*Fin ray counts for certain species of* Istiblennius *and* Salarias *from the Marshall and Marianas Islands*

Species	Fin rays																			
	Dorsal											Anal								
	XII	XIII	XIV	18	19	20	21	22	23	24	25	II	19	20	21	22	23	24	25
I. lineatus		11	1					1	6	4	1	12					3	3	6
I. cyanostigma		11			3	8						10		2	6	2			
I. afilinuchalis [1]		20		1	18	1						20	5	15					
I. rodenbaughi		21		4	16	1						21	6	14	1				
I. gibbifrons [2]		25		1	8	16						25		9	16				
I. paulus	2	9				10	1					11		1	10				
I. edentulus	3	18			4	14	3					20			8	11	1		
I. coronatus	8					5	3					8			6	2			
S. fasciatus	4				4							4	1	3					

[1] From Phoenix and Samoan Islands.

[2] From Johnston and Hawaiian Islands.

ISTIBLENNIUS LINEATUS (Cuvier and Valenciennes)

PLATE 117,A

Salarias lineatus CUVIER and VALENCIENNES, Histoire naturelle des poissons, vol. 11, p. 314, 1836 (type locality, Java).

Salarias multilineatus FOWLER, Proc. Acad. Nat. Sci. Philadelphia, vol. 97, p. 68, fig. 14, 1945 (type locality, Saipan).

SPECIMENS STUDIED

Bikini Atoll: 5 stations, 104 specimens, 20 to 118 mm. in standard length.
Rongelap Atoll: 2 specimens, 89 to 104 mm.
Eniwetok Atoll: 3 stations, 5 specimens, 47 to 98 mm.
Rota Island: 1 lot, 1 specimen, 50 mm.
Saipan: 2 lots, 5 specimens, 18 to 82 mm.
Guam: 1 specimen, 24 mm.

Description.—Dorsal rays XIII,22 to 25, rarely XIV; anal II,23 to 25; pectoral 14, with lower 4 rays, and sometimes 5, thickened; branched caudal 5+4; pelvics I,3; orbital tentacle single, with cirri on its edges; nasal cirri about 4 or 5; no nuchal cirrus.

Head 4.3 to 5.2; greatest depth 5.1 to 5.3; longest pectoral ray 4.9 to 5.6; snout tip to anus, 2.4 to 2.5; anal fin base 1.9 to 2.1; all in standard length. Eye 3.7 to 4.5; snout 2.7 to 2.8; postorbital length of head 1.4 to 1.5; greatest depth of body 1.1 to 1.2; least depth 2.4 to 2.8; longest dorsal spine 1.0 to 1.1; all in length of head. Fleshy interorbital space 2.0 to 2.1 in eye.

Orbital tentacle single, thin, very broad, its length about 1½ to 2 times its greatest width, usually the edges have several short cirri; length of orbital tentacle about equal to eye diameter or little shorter; no nuchal cirrus; nasal cirri short; snout profile with a backward slant from the vertical of about 10 to 15 degrees; edge of upper lip crenulate, lower lip smooth; lateral line arched over pectoral, ending at midlengthwise axis over anus; vertical line through dorsal origin passes a little behind bases of pelvic fins; dorsal fin with a deep notch over last dorsal spine; a membrane attaching last dorsal ray with upper edge of caudal fin base; anal origin under base of second or third from last dorsal spine; last anal ray without membrane attaching it to caudal peduncle; pectoral fins not quite reaching to anus; anal spines small, partly embedded in females; and first anal rays of adult males not swollen at tips; no posterior canines on lower jaw; teeth fine, numerous, movable, of equal size in both jaws; distal margin of caudal fin rounded; cephalic crest of males very well developed, its height often more than 1½ eye diameter.

Color in alcohol.—Background coloration light tan to brown; sides with distinct dark brown to blackish lengthwise parallel lines, or lines may be obsolete, but always there are traces of them on caudal peduncle as a few to many black specks, they may be irregular and sometimes interconnect dorsally or run obliquely toward dorsal fin base; sides of head plain or with some vertical dark streaks; sometimes 6 or 7 vertical dark double bars occur on sides of body; dorsal, anal, and caudal fins dusky, the dorsal fin with numerous transverse whitish and dark lines or streaks; pectoral base dusky with a vertical whitish bar.

Ecology.—This characteristically marked blenny preferred the tidal pools with very shallow water near the high tidal level, frequently occurring in the crevices and solution channels of the beach rock.

ISTIBLENNIUS PAULUS (Bryan and Herre)

PLATE 117,B,C

Salarias paulus BRYAN and HERRE, Occ. Pap. Bishop Mus., vol. 2, No. 1, p. 136, 1903 (type locality, Marcus Island).

SPECIMENS STUDIED

Bikini Atoll: 22 stations, 515 specimens, 19 to 125 mm. in standard length.
Rongelap Atoll: 5 stations, 93 specimens, 51 to 127 mm.
Rongerik Atoll: 3 stations, 37 specimens, 33 to 113 mm.
Eniwetok Atoll: 5 stations, 39 specimens, 39 to 121 mm.
Kwajalein Atoll: 1 station, 5 specimens, 51 to 91 mm.
Guam: 4 lots, 43 specimens, 29 to 98 mm.

Description.—Dorsal rays usually XIII,20, rarely XIII,21; anal II,21, rarely II,20; pectoral 14, with 5 or 6 of lower rays thickened; branched caudal 5+3 or 4; pelvics I,3; orbital cirrus single, simple; nasal cirri 4 to 7.

Head 4.0 to 5.2; greatest depth 5.3 to 7.0; longest pectoral ray 5.0 to 6.2; snout to anus 2.3; anal fin base 1.9 to 2.4; all in standard length. Eye 3.3 to 4.7; snout 2.3 to 3.0; postorbital length of head 1.4 to 1.5; greatest depth of body 1.2 to 1.3; least depth of body 2.0 to 2.2; longest pectoral fin ray 1.2 to 1.3; longest dorsal spine 1.7 to 1.9; all in length of head. Fleshy interorbital space 2.2 to 2.7 in eye.

Orbital cirrus slender, roundish, single, simple, length ½ to ¾ eye diameter; nuchal cirrus single, simple; snout profile with backward slant of about 15 to 20 degrees from the vertical; upper lip crenulate; lower lip smooth; lateral line broadly arched over pectoral fin, curving to midlengthwise axis of body over region of anus and ending there; vertical line through dorsal origin passes through pelvic bases; dorsal fin with a deep notch at last spine, last soft ray with membrane attached to dorsal edge of caudal peduncle; anal origin about under base of second from last dorsal spine, last anal ray without membrane attaching it to caudal peduncle; pectoral fins reaching only about ⅔ the way to the anus; anal spines small without enlarged dermal pads in adult male; posterior canine tooth each side of lower jaw present; teeth fine, numerous, movable of equal size in both jaws; distal edge of caudal fin truncate to slightly concave; large adult males with low fleshy ridge or crest dorsally on head, this ridge not exceeding ⅓ pupil diameter: small males and females with no trace of this ridge.

Color in alcohol.—Background color of adult males light brown or light tan, more whitish ventrally, with 7 dark bars on sides and lower sides but absent or obscure dorsally, each bar double ventrally or Λ-shape; a small blackish spot or silvery blue spot with black margins on gill cover near its upper middle; a pale or whitish spot behind eye, margined posteriorly with a blackish line; nasal cirri usually pale or white; on middle of sides in the dark bars are 5 or 6 pairs of bright silvery to bluish white spots bordered by a black line; anal fin and lower part of caudal fin blackish; caudal fin white dorsally and on distal third, basally dark brown. Background color of females and smaller males light tan to whitish; the 7 double dark brown bars on sides sometimes represented more or less as 4 oblong dark spots; basal ⅔ of dorsal fin blotched or spotted with brown or the fin may be clear; the small dark opercular spot and the spot behind eye present or absent; underside of head whitish, dotted with brown pigment cells; the black-bordered silvery spots on sides usually distinct, but sometimes scarcely discernible, especially on the smallest specimens; basally the pectoral has fine black dots; ventral part of caudal fin dusky, dorsally white; tips of anal rays dusky, basally white.

Color when alive.—Background color of male light olive tan dorsally, white ventrally; bars on sides dark blackish brown; pale spots or oblong spots bright bluish silvery, margined with dark blue line; head and distal third of dorsal fin with tiny, very pale, pinkish dots; soft dorsal fin edged with pale orange; the bronze-colored spot behind eye is bordered posteriorly by light bluish silver, opercular spot bluish silver; and another bluish silver spot at corner of mouth on maxillary; base of pectoral blackish, rest of fin light tan; anal fin blackish. Caudal fin with rear edge light orange, middle and dorsal portion light yellowish, basal and ventral part blackish; iris with bronze bars.

Ecology.—*S. paulus* is one of the commonest species of blennies on the reefs, and it prefers the higher tidal part where there are crevices and large loose blocks among which to hide. In some of the shallow tidal pools and small solution channels on the reefs, exposed at low tide or covered with only a few inches of water, dozens of these blennies may be seen in a characteristic pose—head a little elevated by means of the paired fins, tail curved to one side, and an alert expression in the eye; sometimes most of the fish is out of the water, and to catch it is difficult because with a slight flip this blenny is perched a yard or more away, or it flips from place to place and disappears at a distance of 25 feet or more into some unseen crevice. This species was more abundant where wave action was strong and where an abundance of loose reef-blocks and crevices occurred. It was not encountered in the Lithothamnium ridge area.

Remarks.—Two forms of this type of fish can be distinguished among specimens from the tropical Indo-Pacific; those from Polynesia, Micronesia, and Melanesia differ from those in the East Indies and Indian Ocean in the following details: The small black dots on the body, pectoral base, so typical of females and somewhat developed in the males of *I. periophthalmus* (Cuvier and Valenciennes) from the Indian Ocean and western Pacific are completely absent in the form from Oceania, *I. paulus;* the dashes behind the eye are not united over the top of the head; the opercular spot is not strongly developed; the alternating dark and light bands over upper lip are poorly developed or absent; and the bars on sides range from very strong to nearly absent.

ISTIBLENNIUS CORONATUS (Günther)

PLATE 117,D

Salarias coronatus GÜNTHER, Ann. Mag. Nat. Hist., ser. 4, vol. 10, p. 424, 1872; Fishes, *in* Brenchley, Jottings during the cruise of H. M. S. *Curacoa. . .* , p. 424, pl. 33B, 1873 (type locality, Solomon Islands).

Salarias aureo-puncticeps FOWLER, Proc. Acad. Nat. Sci. Philadelphia, vol. 98, p. 179, figs. 43, 44, 1946 (type locality, Riu Kiu Islands).

SPECIMENS STUDIED

Bikini Atoll: 12 stations, 123 specimens, 22 to 96 mm. in standard length.
Rongelap Atoll: 3 stations, 4 specimens, 70 to 107 mm.
Rongerik Atoll: 4 stations, 10 specimens, 34 to 105 mm.
Eniwetok Atoll: 2 stations, 4 specimens, 54 to 97 mm.
Kwajalein Atoll: 1 station, 27 specimens, 40 to 91 mm.
Guam: 1 specimen, 34 mm.
Rota Island: 1 specimen, 17 mm.

Description.—Dorsal rays usually XII,20, occasionally XII,21; anal usually II,21, occasionally II,22; pectoral usually 14, rarely 15, with lower 5 rays (rarely 6) thickened; branched caudal 5+4; pelvics I,3; orbital tentacle with tip usually bifid or sometimes with 3 or 4 cirri; nuchal cirrus present or absent, always very minute, usually present on one side, absent on other; nasal flap with 4 to 6 cirri on its tip.

Head 4.0 to 5.0; greatest depth 4.4 to 5.3; longest pectoral ray 5.3 to 6.0; snout to anus 1.9 to 2.2; anal fin base 2.0 to 2.2; all in standard length. Eye 3.3 to 4.5; snout 2.8 to 3.1; postorbital length of head 1.3 to 1.5; greatest depth of body 1.1 to 1.2; least depth of body 2.1 to 2.2; longest pectoral fin ray 1.2 to 1.3; longest dorsal spine 1.4 to 2.0; all in length of head. Fleshy interorbital space 2.5 to 3.5 in eye.

Orbital cirrus slender but notably broad, much broader than thick, even in the young, its tip with 2 to 4 cirri, its length about ½ to ¾ diameter of eye, width same near tip as at base; nuchal cirrus very small, simple, threadlike, usually present on one side absent on the other, occasionally absent, and occasionally present on both sides; snout profile with backward slant of about 15 to 20 degrees from vertical; upper lip a little crenulate, lower lip smooth edged; lateral line arched over pectoral fin, incomplete, ending a little in front of a vertical line through anal origin; vertical line through dorsal origin passes through pelvic bases; dorsal fin with a deep notch at last spine; last soft dorsal ray with membrane attached to dorsal edge of caudal peduncle; anal origin about under base of second from last dorsal spine; last anal ray without membrane posteriorly; pectoral fins reach only ⅔ to ¾ the way to anus; anal spines small, without enlarged dermal pads in adult males; posterior canine present on each side of lower jaw; teeth fine, numerous, movable, of equal size in both jaws; distal margin of caudal fin asymmetrical, lower branched rays a little longer, margin truncate or a little concave; large adult males with a very low fleshy ridge, scarcely more than a wrinkle, on dorsal side of head, small males and females without this ridge.

Color in alcohol.—Background coloration of females pale tan with traces of about 9 double bars usually represented by a few tiny blackish or purplish brown spots or short vertical dark lines arranged so the upper two spots are a little above the midsides and the lower pair of spots on lower part of sides; in some of the larger females there are black specks scattered irregularly dorsally and posteriorly; tips of each dorsal spine black; tips of anal rays blackish in anterior half of fin; middle of pectoral fin with scattered brown or black specks; dorsal surface of head dusky with several roundish white spots size of pupil and smaller; peritoneum dark brown or blackish. Background coloration of males from light tan to dark brownish, usually with a purplish tinge ventrally and sometimes with purplish blotches on sides; usually a conspicuous purplish black spot the size of pupil to half eye diameter on middle of side opposite base of about second soft dorsal ray; tip of each dorsal spine blackish, and white spots on dorsal surface of head as in females; dorsal fin usually with brownish reticulated lines in distal parts, and margin of soft dorsal white; anal dusky to blackish; lower half of caudal fin dusky to blackish, dorsal half white; anterodorsal part of body sometimes with numerous fine brown specks, and sides with white specks showing on the dark brown; usually a small dark spot behind eye and one just behind rear tip of maxillary; underside of head with traces of brownish blotches more or less suggesting one or two cross bars.

Remarks.—The East Indian form of this species is *I. chrysospilos* (Bleeker). The Micronesian, Melanesian, and Polynesian form is *I. coronatus.* The male of the latter always has on middle of side a prominent dark spot, absent on females, whereas both sexes of the East Indian form have this dark spot. On *I. coronatus* there are dark crescents on the throat; 3 to 5 rows of sharply defined black specks across the pectoral; and the male has short, very narrow, horizontal white dashes on sides, not spots and vermiculations, as in the East Indian form.

The terminology of the species has been confused since Günther in 1877 figured the male as *S. nitidus,* whereas the true *I. nitidus* (Günther 1861), from the China coast, is a species of *Rhabdoblennius,* similarly colored. Günther previously described the female as *I. coronatus.* Jordan and Seale (1906) perceived Günther's error on the male and introduced the new name *Alticus evermanni* for the Polynesian form. McCulloch (1926) noted that the name *S. belemnites* De Vis had priority, for *coronatus,* but overlooked Bleeker's species. He described the orbital cirrus as simple, but corrected this statement in his unpublished manuscript for the Atlas, stating the orbital tentacle was bifid at the tip.

The small females of *I. coronatus* might be confused with *I. paulus.* The former has the orbital tentacle much broader than thick whereas that of *paulus* is slender, tapering to a point and roundish in cross-section without the tip being divided.

ISTIBLENNIUS EDENTULUS (Bloch and Schneider)

PLATE 118,A,B

Blennius edentulus BLOCH and SCHNEIDER, Systema ichthyologiae . . . , p. 172, 1801 (type locality, Huahaine Island, Society Group).

Salarias fluctuatus FOWLER, Proc. Acad. Nat. Sci. Philadelphia, vol. 97, p. 70, figs. 15, 16, 1945 (type locality, Saipan).

Salarias personatus, FOWLER, Proc. Acad. Nat. Sci. Philadelphia, vol. 97, p. 71, fig. 17, (type locality, Saipan).

Salarias atrimarginatus FOWLER, Proc. Acad. Nat. Sci. Philadelphia, vol. 98, p. 182, fig. 46, 1946 (type locality, Riu Kiu Islands).

SPECIMENS STUDIED

Bikini Atoll: 7 stations, 92 specimens, 19 to 112 mm.
Rongelap Atoll: 9 specimens, 78 to 105 mm.
Eniwetok Atoll: 8 specimens, 63 to 85 mm.
Kwajalein Atoll: 5 specimens, 50 to 99 mm.
Guam: 2 lots, 8 specimens, 16 to 80 mm.
Saipan: 2 lots, 14 specimens, 18 to 68 mm.

Description.—Dorsal rays XII or XIII,19 to 21, rarely XII; anal II,20 to 23, rarely 20 or 23; pectoral 14, with lower 5 rays thickened;

branched caudal 5+4 in adults but unbranched in young, branching beginning at about 27 mm. in standard length; pelvics I,3; orbital cirrus single, sometimes adults will have 1 or 2 cirri arising from sides at tip; nuchal cirrus single on each side rarely bifid; nasal cirri from 1 to 10, increasing in number with increase in size.

Head 3.7 to 4.4; greatest depth 4.7 to 4.8; longest pectoral ray 4.2 to 4.9; snout tip to anus 2.0 to 2.2; anal fin base 2.1 to 2.2; all in standard length. Eye 3.0 to 5.0; snout 2.5 to 2.8; postorbital length of head 1.6 to 1.7; greatest depth of body 1.2 to 1.3; least depth 2.6 to 2.7; longest pectoral ray 1.1 to 1.2; longest dorsal spine 1.6 to 1.7; all in length of head. Fleshy interorbital space 2.8 to 3.0 in eye.

Orbital tentacle single, thin, much broader than thick, and wide basally, tapering to a point distally, its length about ½ to ¾ eye diameter; occasionally 1 or 2 cirri branch off the edge of the orbital tentacle near its tip; nuchal cirrus on each side of nape single, thin, much broader than thick basally, tapering to a point; snout profile with a backward slant of about 10 to 15 degrees from the vertical; both lips smooth edged; lateral line arched over pectoral fin, then continuing on midlengthwise axis of body as several isolated pores ending at about over middle of anal fin base; vertical line through dorsal origin passes through bases of pelvic fins; dorsal fin with a moderately deep notch between spiny and soft portions; dorsal fin with membrane attaching last ray to basal part of dorsal edge of caudal fin; anal origin under base of next to last dorsal spine, last anal ray without membrane attaching it to caudal peduncle; pectoral fins not quite reaching to opposite anus; anal spines small, embedded, without swollen fleshy tips, except in adult males (the first six soft anal rays on mature males greatly swollen and convoluted, the next 3 or 4 slightly so); no posterior canines; teeth fine, numerous, movable, of equal size in both jaws; distal margin of caudal fin rounded; cephalic crest well developed in males, absent in females.

Color in alcohol.—Half grown, up to about 55 mm., are plain brown or blackish with traces of dark brown specks posteriorly on body of females and sometimes on dorsal fin; dorsal and anal fins dusky; cephalic crest blackish; vertical bars present or obsolete. Background coloration of adult females brown to pale tan or whitish usually with or without 6 or 7 more or less double dark bars on sides, posterior part of body and dorsal fin finely speckled with dark brown specks or dots; caudal, pectoral and pelvic fins plain pale to light gray; anal fin light gray or dusky with tips of rays paler. Background coloration of adult males brownish or light brownish with or without 6 or 7 darker double vertical bars usually evident; dorsal fin dusky distally with lengthwise narrow pale or whitish streaks or light punctulations distally, dorsal fin lighter basally; cephalic crest blackish; anal fin dusky, sometimes with narrow pale streaks; caudal fin dark brown; side of head sometimes with irregular pale markings.

Ecology.—This species was found, but not abundantly, in high tidal pools or ponds or along the ocean reef where strong wave action predominated and where there were plenty of crevices in which to hide. It seemed to prefer the pools and solutions channels exposed along the high tidal zone.

ISTIBLENNIUS CYANOSTIGMA (Bleeker)

PLATE 117,E

Salarias cyanostigma BLEEKER, Verh. Bataviaasch Gen., vol. 22, pp. 5, 7, 18, 1849 (type locality, Pagatang, Soenda-Molukschen Archipelago).

SPECIMENS STUDIED

Guam: 5 lots, 111 specimens, 25 to 73 mm. in standard length.
Rota Island: 83 specimens, 22 to 74 mm.
Saipan: 2 specimens, 52 and 63 mm.

Description.—Dorsal rays XIII,19 or 20; anal II,20 or 21; pectoral 14, with 4 or 5 lower ones thickened; branched caudal 5+4; pelvics I,3; orbital cirrus single over each eye; no nuchal cirrus; nasal cirri 2 or 3.

Head 4.0 to 4.8; greatest depth 4.8 to 6.4; longest pectoral ray 4.4 to 5.5; snout tip to anus 2.0 to 2.4; anal fin base 2.3; all in standard length. Eye 3.0 to 4.4; snout 3.2 to 3.5; postorbital length of head 1.4 to 1.5; greatest depth of body 1.2 to 1.3; least depth 2.4 to 2.5; longest pectoral ray 1.2 to 1.3; longest dorsal spine 1.7 to 2.0; all in length of head. Fleshy interorbital space 3.0 to 3.3 in eye.

Orbital tentacle single, slender, tapering to a point, its length about equal to eye diameter; basal part of orbital tentacle notably broader than thick; no nuchal cirrus; nasal cirri very short; snout profile with a backward slant of about 10 to 20 degrees from the vertical; edges of both upper and lower lips smooth; lateral line arched over pectoral fin and ending near midlengthwise axis of body a little in front of a vertical line through anus; vertical line through dorsal origin passes through pelvic bases; dorsal fin with deep notch over last dorsal spine; a membrane attaching last dorsal ray with upper edge of base of caudal fin; anal origin opposite base of next to last dorsal spine; last anal ray without posterior membrane, or free from caudal peduncle posteriorly; pectoral fins not reaching to point opposite anus; anal spines small, in females mostly embedded; first anal rays on adult males not notably swollen; no posterior canines on lower jaw; teeth fine, numerous, movable, of equal size in both jaws; posterior margin of caudal fin rounded; cephalic crest very well developed on adult males, its height nearly equal to eye diameter, in females this crest is equal in height to pupil diameter.

Color in alcohol.—Body and head of males plain light brownish to tan, with dorsal, anal, and caudal fin dusky to blackish; caudal fin white edged distally; dorsal fin with light or white streaks distally; sides sometimes with traces of 7 or 8 vertical darkish bars, sometimes traces of 2 lengthwise dark lines about opposite tip of pectoral fin: sides with 2 or 3 rows of small pale-centered spots edged with dark, spaced as part of vertical bars; pectoral fin unspotted; just behind and at upper edge of eye a very small dark spot, another behind lower edge of eye, both may be pale centered with dark edges, in upper part of opercle another small dark spot, all three of these rather tiny spots persistent in appearance but somewhat indistinct. Background coloration of females light tan, with 4 lengthwise black lines on sides beginning about opposite tip of pectoral fin and breaking up into black dots posteriorly; the upper 3 lines are on middle of sides, evenly spaced, whereas the most ventral black line is more widely spaced and runs along lower part of side; dorsal and caudal fins distinctly barred with small black spots; anal fin dusky distally, with a row of spots or transverse dark line basally. Peritoneum blackish and edge of lower lip dusky in both sexes.

Ecology.—This species was taken in shallow rocky tidal pools left during low tide.

Remarks.—Day described this species as *Salarias andamensis, S. andamanensis* and *S. striolatus;* Günther as *S. caudolineatus.*

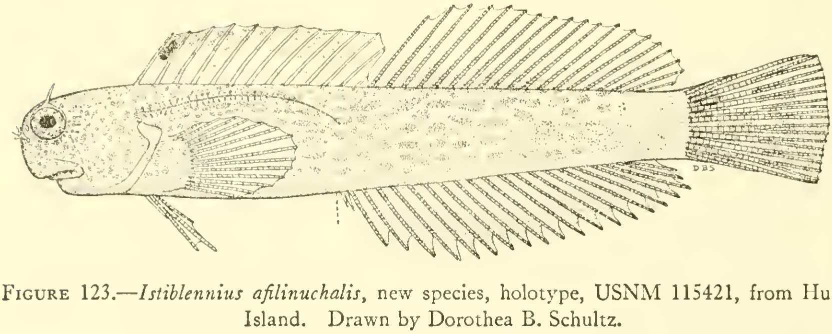

FIGURE 123.—*Istiblennius afilinuchalis*, new species, holotype, USNM 115421, from Hull Island. Drawn by Dorothea B. Schultz.

ISTIBLENNIUS AFILINUCHALIS, new species

FIGURE 123

Salarias gibbifrons, SCHULTZ, U. S. Nat. Mus. Bull. 180, p. 284, 1943 (Enderbury, Hull, and Swains Islands).

Holotype.—USNM 115421, Hull Island, channel, July 7–17, 1939, Schultz, standard length 88 mm., male.

Paratypes.—USNM 115419, Hull Island, reef, July 12–15, 1939, Schultz, 34 specimens, 24 to 61.5 mm.; USNM 111886, Hull Island, channel, July 7–17, 1939, Schultz, 28 specimens, 20 to 61 mm.; USNM 115420, Enderbury Island, reef, May 15–19, 1939, Schultz, 53 specimens, 38 to 80 mm.; USNM 115422, Swains Island, reef, May 3–9, 1939, Schultz, 90 specimens, 23 to 66 mm.

The following counts were made on the holotype: Dorsal rays XIII,19; anal II,20; pectoral 14–14; branched caudal 5+4; pelvics I,3–I,3; orbital cirrus single above each eye; no nuchal cirrus; nasal cirri 3–4. Additional counts were made on numerous paratypes and these data for dorsal and anal fins are recorded in table 113; for these paratypes the branched caudal rays are always 5+4; pelvics always I,3; pectoral 14, with lower 5 rays enlarged.

Head 4.0 to 4.4; greatest depth 4.8 to 5.2; longest pectoral ray 3.8 to 5.3; snout tip to anus 2.0 to 2.1; anal fin base 2.4 to 2.5; all in standard length. Eye 3.0 to 3.9; snout 3.0 to 3.5; postorbital length of head 1.6 to 1.7; greatest depth of body 1.1 to 1.4; least depth 2.2 to 2.9; longest pectoral ray 1.0 to 1.1; longest dorsal spine 1.6 to 1.8; all in length of head. Fleshy interorbital space 2.9 to 3.1 in eye.

Orbital tentacle single, much broader than thick basally, tapering to a point distally, its length about ⅔ to ⅘ eye diameter; no nuchal cirrus; nasal tentacle with from 2 to 6 short cirri; snout profile with a backward slant of 10 to 20 degrees from vertical; both lips smooth edged; lateral line arched over pectoral, curving toward midlengthwise axis and ending about over anus; vertical line through dorsal origin passes through pelvic bases; dorsal fin with moderately deep notch over last dorsal spine; dorsal fin with membrane attaching last ray to upper edge of caudal peduncle but not to base of caudal fin; anal origin under base of next to last dorsal spine; last anal ray without membrane attaching it to caudal peduncle; pectoral fins not quite reaching to anus; anal spines small, embedded in females; first few soft anal rays of adult males with slightly swollen smooth tips; posterior canine present in lower jaw; teeth fine, numerous, movable, of equal size in both jaws; distal margin of caudal fin truncate, or nearly so, to slightly undulating; no cephalic crest developed in adult males.

Color in alcohol.—Background coloration of adult males light tan, with numerous light brown spots on head separated by whitish interconnecting lines or streaks, those on body larger; lower sides of body with about 3 irregular rows of oblong pale-centered spots edged with diffuse brown pigment; underside of head plain light to dark brownish; spiny dorsal with one or two black spots distally between first to third spines, then the distal half blotched with brownish, basally plain pale; soft dorsal pale distally but basally dusky, and tips of first few soft rays blackish, anal plain dusky; caudal dusky in ventral part lighter dorsally, sometimes with traces of a few darker spots; in front of pectoral base sometimes brownish spots, the fin unspotted, except sometimes traces of spots basally. Background coloration of females light tan, with numerous small brownish spots on head and body separated by whitish interconnecting lines or streaks; lower sides with double or Λ-shaped bars; dorsal and caudal fins barred with small black spots; anal fin with dark pigment distally but tips of rays whitish and the membrane between every other anal ray dark brownish; lower lip usually edged with dark brown; under side of head with 3 transverse brownish bars, rear bar usually interrupted near midventral region and front bars more or less joined midventrally by diffuse brownish pigment.

Color when alive.—The whitish lines or narrow spaces between the light brownish spots probably were reddish and in alcohol fade out to whitish.

Ecology.—This species was taken on the open reef and in channels where wave action was strong.

Remarks.—This species is closely related to *I. gibbifrons* and *I. rodenbaughi*, new species, differing in certain details of color pattern as described and compared in the key, especially in regard to the brown transverse bars, not occurring on the other two species, which are found on females on under side of head.

Named *afilinuchalis* in reference to the absence of the nuchal filament which often occurs in other species of the genus *Istiblennius*.

TABLE 114.—*Certain measurements on holotype and a paratype of* Istiblennius rodenbaughi *and* I. afilinuchalis, *expressed in thousandths of the standard length*

Characters	*I. rodenbaughi*, new species		*I. afilinuchalis*, new species	
	Holotype	Paratype	Holotype	Paratype
Standard length in mm. (frontmost part of head to base of caudal fin)	79	75.5	73	59.5
Head	222	226	214	227
Greatest depth of body	165	199	168	175
Least depth of body	92	105	100	84
Postorbital length of head	166	144	149	158
Eye	49	52	55	54
Snout	67	72	79	77
Interorbital space (fleshy)	18	15	14	17
Length of orbital cirrus	42	28	42	42
Longest dorsal spine	120	117	116	124
Longest soft dorsal ray	152	142	164	138
Longest soft anal ray	146	103	145	123
Longest pectoral ray	186	183	157	202
Longest pelvic ray	133	138	130	143
Longest caudal ray	228	208	205	223
Snout tip to anus	494	496	452	474
Snout tip to dorsal origin	177	191	185	217
Length of anal fin base	430	408	437	424

ISTIBLENNIUS RODENBAUGHI, new species

PLATE 117,F

Holotype.—USNM 142067, Bikini Atoll, Namu Island, ocean reef and surf, August 7, 1947, S–1019, Brock, Hiatt and Schultz, standard length 79 mm.

Paratypes.—USNM 142074, Bikini Atoll, Enyu Island, reef at entrance, March 16, S–46–7, Schultz, Brock and Marr, 3 specimens, 32 to 82 mm.; USNM 142077, Bikini Atoll, Namu Island, ocean reef, April 4, S–46–51, Schultz, 15 specimens, 37 to 72 mm.; USNM 142075, Bikini Atoll, Bokon Island, ocean reef and surf, April 15, S–46–94, Schultz and Brock, 3 specimens, 62 to 71 mm.; USNM 142076, Bikini Atoll, Airy Island, ocean reef and surf, April 16, S–46–96, Schultz, 10 specimens, 45 to 81 mm.; USNM 142073, Bikini Atoll, Cherry Island, high tidal pool, April 18, S–46–99, Schultz, 2 specimens, 27 to 43 mm.; USNM 142078, Bikini Atoll, 2 km. west of Bikini Island, ocean surf, May 1, S–46–120, Schultz, 23 specimens, 27 to 75 mm.; USNM 142072, Bikini Atoll, Reer Island, August 12, S–46–332, Herald and Brock, 1 specimen, 40 mm.; USNM 142079, Bikini Atoll, Enyu Island, ocean reef, August 13, S–46–333, Herald, 16 specimens, 50 to 89 mm.; USNM 142071, Bikini Atoll, Oruk Island, ocean reef, August 16, S–46–382, Herald, 2 specimens, 50 to 56 mm.; USNM 142069, Bikini Atoll, Eman Island, ocean surf and reef, July 19, 1947, S–46–441, Schultz, Brock, Myers, and Hiatt, 42 specimens, 33 to 99 mm.; USNM 142070, Bikini Atoll, Enyu Island, ocean reef at channel, August 1, S–46–483, Schultz, Brock, and Hiatt, 1 specimen, 59 mm.; USNM 142068, Bikini Atoll, Namu Island, ocean reef and surf, August 7, 1947, S–1019, Brock, Hiatt, and Schultz, 13 specimens, 36 to 76 mm.; USNM 142080, Rongerik Atoll, Eniwetok Island, ocean reef and surf, June 29, S–46–241, Schultz and Herald, 21 specimens, 36 to 102 mm.; USNM 142082, Rongelap Atoll, Enybarbar Island, ocean reef in high tidal channels, June 18, S–46–216, Schultz, 3 specimens, 52 to 92 mm.; USNM 142081, Rongelap Atoll, Tufa Island, ocean reef, July 18, S–46–260, Herald and Brock, 2 specimens, 41 to 90 mm.; USNM 142083, Eniwetok Island, ocean reef and surf, May 20, S–46–159, Schultz, 2 specimens, 66 to 67 mm.; USNM 142084, Eniwetok Atoll, Mui Island, ocean reef and surf, May 28, S–46–186, Schultz, 7 specimens, 48 to 74 mm.

Description.—The following counts were made on the holotype: Dorsal rays XIII,19; anal II,20; pectoral 14–14; branched caudal 5+4; pelvics I,3 — I,3; orbital tentacle 1–1; nasal cirri 2–3. Additional counts were made on numerous paratypes and these data for dorsal and anal fins are recorded in table 113; for these paratypes the branched caudal rays are always 5+4, pelvics always I,3; pectoral 14, rarely 15, with lower 5 enlarged or swollen.

Head 3.8 to 4.5; greatest depth 5.0 to 5.8; longest pectoral ray 4.3 to 5.2; snout tip to anus 2.2; anal fin base 2.4 to 2.5; all in standard length. Eye 3.5 to 4.0; snout 3.0 to 3.3; postorbital length of head 1.4 to 1.6; greatest depth of body 1.3 to 1.4; least depth 2.3 to 2.7;

longest pectoral ray 1.0 to 1.2; longest dorsal spine 1.7 to 1.8; all in length of head. Fleshy interorbital space 2.0 to 3.0 in eye.

Orbital tentacle single, much broader than thick basally, tapering to a point distally, its length from 2/3 to a little more than eye diameter; no nuchal cirrus; nasal tentacle with from 2 to 6 short cirri; snout profile with a backward slant of about 10 to 20 degrees from vertical; both lips smooth edged; lateral line arched over pectoral fin, then ending above midlengthwise axis of body about opposite anal fin origin; vertical line through dorsal origin passes a trifle in front of pelvic bases; dorsal fin with moderately deep notch over last dorsal spine; dorsal fin with membrane attaching last ray to upper edge of caudal peduncle but not to base of caudal fin; anal origin under base of next to last dorsal spine; last anal ray without membrane attaching it to caudal peduncle; pectoral fin not quite reaching to anus; anal spines small, embedded in females; first few anal rays, in adult males with slightly swollen smooth tips; posterior canines present in lower jaw; teeth fine, numerous, movable, of equal size in both jaws; distal margin of caudal fin truncate to slightly rounded or a little undulating; no cephalic crest developed in adult males.

Color in alcohol.—Background coloration of adult males light tan, with numerous brown spots on head separated by whitish interconnecting narrow streaks or lines; those on body larger but not as dark; lower sides with 3 irregular rows of pale oblong spots edged with brown; underside of head light brownish to dark brown; spiny dorsal with numerous light brownish spots; soft dorsal pale distally but basally dusky or brownish and tips of first few rays blackish; anal plain dusky; caudal dusky in lower half, lighter in dorsal part and with traces of dark spots; pectoral dark spotted basally, sometimes the fin has indications of dark bars.

Background coloration of females very light tan, with numerous faint but distinct light and dark spots on head and some on body, the latter when examined microscopically are made of groups of blackish pigment cells; lower part of side a little above anal fin base with a row of spots representing the obsolete vertical bars; dorsal and caudal fins barred with small black spots; anal fin with a dusky spot basally on membrane between every other anal ray and usually another one halfway out; anal fin distally with dark pigment but tips of rays are whitish; lower lip with diffuse dusky pigment; underside of head plain light brown. In both males and females each membrane between first three dorsal spines with black spots.

Color when alive.—Based on two kodachromes taken in field, one of the holotype. Background coloration of males whitish below, tinged with light pinkish brown dorsally, the white interspaces in alcohol between the dark spots are light brick reddish, and form a reticulated pattern; the three rows of pale spots on lower sides in alcohol are light bluish, edged with light brownish; dorsal fin tinged with pinkish distally.

Ecology.—This new species was rather common along the open ocean reef in surf and surflike conditions, where the reef was flat and with little coral growth. The flat part of the reef usually was covered with a sand and algal carpet a few inches thick.

Remarks.—This new species is closest to *I. gibbifrons* and *I. afilinuchalis*, from which it may be separated by means of the key.

Named *rodenbaughi* in honor of Dr. Frederick H. Rodenbaugh, Sr., who assisted us in many ways at Bikini in 1946–47.

Genus SALARIAS Cuvier

Salarias Cuvier, Regne animal, ed. 1, vol. 2, p. 251, 1817 (type species, *Salarias quadripennis* Cuvier=*Blennius fasciatus* Bloch).

Erpichthys Swainson, Natural history and classification of fishes . . ., vol. 2, pp. 79, 182, 275, 1839 (type species, *Salarias quadripennis* Cuvier.)

SALARIAS FASCIATUS (Bloch)

Plate 118,C,D

Blennius fasciatus Bloch, Naturgeschichte ausländischen Fische, vol. 1, p. 110, 1786 (East Indies).

SPECIMENS STUDIED

Guam: 2 lots, 4 specimens, 30 to 76 mm. in standard length.

Description.—Dorsal rays XII,19; anal II,19 or 20, usually II,20; pectoral 14 or 15, usually 14; pelvics I,2; orbital cirri 1 to 3; nuchal flap with 5 to 12 cirri on its edges; nasal cirri 1 to 4. See table 113 for additional counts.

Head 3.2 to 4.2; greatest depth 3.7 to 4.3; longest pectoral ray 4.5 to 4.8; snout tip to anus 1.9 to 2.0; anal fin base 2.1 to 2.2; all in standard length. Eye 3.3 to 3.7; snout 2.5 to 3.0; postorbital length of head 1.7; greatest depth of body 1.0 to 1.1; least depth 2.5 to 3.0; longest pectoral ray 1.2; longest dorsal spine 1.7 to 2.1; all in length of head. Fleshy interorbital space 2.0 to 2.1 in eye.

Orbital tentacles branched to base, composed of 1 to 3 unbranched cirri, usually only 1 cirrus in young, its length about 2/3 to 3/4 eye diameter; nuchal dermal flap broad and thin, with numerous cirri on its edges; nasal cirri short; snout profile nearly vertical; edges of both lips smooth; lateral line over pectoral fin incomplete, ending about opposite anus above midlengthwise axis of body; vertical line through dorsal origin passes through pelvic bases; dorsal fin without notable notch over last dorsal spine; membrane attaching last dorsal ray to basal fifth of dorsal edge of caudal fin; anal origin under base of next to last dorsal spine; last anal ray with a small membrane posteriorly and basally connecting with caudal peduncle; pectoral fins not quite reaching anus; anal spines embedded on females and tips of first anal rays of adult males not swollen at tips; posterior canines absent; teeth fine, numerous, movable, of equal size in both jaws; distal margin of caudal fin rounded; cephalic crest absent.

Color in alcohol.—Background coloration light brown to brownish, with 8 vertical, double, dark brown bars, more or less connected, ending both dorsally and ventrally at bases of median fins to form double dark spots; anterior part of body with round whitish spots from size of pupil to that of eye; anterior part of body with numerous lengthwise, short, parallel black lines, more widely spaced on lower sides of body, anteriorly above pectoral fin, the body and spiny dorsal finely spotted with black dots; posteriorly the body lacks the black lines; pectoral fin dark spotted; dorsal with round white spots; soft dorsal with a series of black spots submarginally; head plain brown with a few dark brown spots; underside of head with two transverse, broad, dark brown bands, edge of gill membrane brown; a broad transverse dark brown band through base of pelvics, another across abdomen between pectoral bases sometimes another across abdomen about equidistant between pelvic bases and anal origin; caudal fin dark spotted in basal two-thirds.

FALLACIRRIPECTES, new genus

Type species.—Fallacirripectes minutus, new species.

This new genus of salariian blenny is characterized by having XII,10 or 11 dorsal rays; II,11 or 12 anal rays; 15 pectoral rays; I,4 pelvics, a single pair of simple nuchal and nasal dermal flaps or cirri, no orbital cirrus; pair of posterior canines present on lower jaw, no nuchal crest; other characters are those of the type species.

Fallacirripectes is intermediate between *Cirripectes* and *Entomacrodus* but is closest to *Cirripectes*, which it resembles in having XII dorsal spines, 15 pectoral rays, and no vomerine teeth; none of these are characteristic of *Entomacrodus*. All three genera are compared in table 115.

TABLE 115.—*Comparison of certain characters in three related genera of the Salariinae*

Characters	*Cirripectes*	*Fallacirripectes*	*Entomacrodus*
Nasal cirrus	multicirrate	simple	multicirrate.
Orbital tentacle	simple or branched	absent	simple or branched.
Nuchal cirri	transverse row of 20 to 60 cirri.	single, simple pair	single, simple, pair absent occasionally.
Vomerine teeth	absent	absent	small conical short teeth in row across bead of vomer.
Anal spines of adult male bearing swollen convoluted dermal pads.	present	present	present or only swollen without convolutions.
Dorsal rays	XI or XII,12 to 15	XII,10 or XII,11	XIII,13 to 16.
Anal rays	II,13 to 16	II,11 occasionally II,12	II,13 to 18.
Pectoral rays	15	15	14.

This new genus may be distinguished from other salariian genera by means of the key to genera of that subfamily.

Named *Fallacirripectes* because of its "false" appearance of resembling *Cirripectes.*

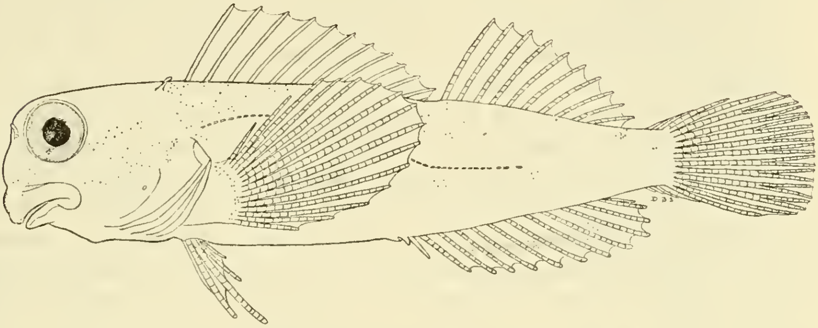

FIGURE 124.—*Fallacirripectes minutus*, new species, holotype, USNM 142153, from Bikini Atoll. Drawn by Dorothea B. Schultz.

FALLACIRRIPECTES MINUTUS, new species

FIGURE 124

Holotype.—USNM 142153, Bikini Atoll, Eman Island, ocean reef in surf, July 19, 1947, S–46–441, Schultz, Brock, Myers, and Hiatt, standard length, 21.4 mm., female.

Paratypes.—USNM 142152, taken with holotype and bearing same data, 2 specimens, 18 and 20 mm.; USNM 142151, Bikini Atoll, lagoon reef halfway between Bikini and Amen Islands, July 21, 1947, S–46–442, Brock, Hiatt, and Schultz, 1 specimen, 15 mm.; USNM 142150, Eniwetok Atoll, Jieroru Island, ocean reef, May 21, S–46–174, Schultz, 2 specimens, 16 to 19 mm.; USNM 142149, Eniwetok Atoll, Mui Island, ocean reef in surf, May 28, S–46–186, Schultz, 6 specimens, 12 to 19 mm.

Description.—Dorsal rays XII,10, except XII,11 in one paratype; anal II,11, except II,12 in two paratypes; pectoral 15, with lower 5 rays enlarged; branched caudal 5+4; pelvics I,4; no orbital tentacle; nuchal cirrus simple, single on each side; nasal tentacle single, simple on each side. Counts were made on all the specimens. The following measurements made on the holotype and a male paratype are recorded below in thousandths of the standard length, which is, respectively, 21.4 and 18.9 mm.: Length of head 322 and 312; greatest depth 234 and 227; least depth of body 75 and 90; postorbital length of head 178 and 190; diameter of eye 75 and 85; length of snout 136 and 132; fleshy interorbital space 28 and 31; longest dorsal spine 131 and 148; longest soft dorsal ray 149 and 169; longest anal ray 107 and 106; longest pectoral ray 304 and 291; longest pelvic ray 201 and

190; longest caudal ray 229 and 238; snout to anus 608 and 556; snout tip to dorsal origin 313 and 328; length of anal base 294 and 360.

Head 3.0 to 3.2; greatest depths 3.4 to 3.7; longest pectoral ray 3.1 to 3.3; snout tip to anus 1.6 to 1.8; anal fin base 2.8 to 2.9; all in standard length. Eye 3.0 to 3.1; snout 2.4 to 2.5; postorbital length of head 1.9 to 2.0; greatest depth of body 1.1 to 1.2, least depth 2.9 to 3.0; longest pectoral ray 1.0 to 1.1, longest dorsal spine 1.8 to 2.0; all in length of head. Fleshy interorbital space 2.2 to 2.5 in eye.

Orbital tentacle absent; nuchal cirrus on each side single, simple, short; nasal cirrus single short oblong dermal flap on each side; snout profile a little rounded, nearly vertical or with a slight forward slant; edge of upper lip smooth except for a single shallow notch at midanterior end; lower lip smooth edged; lateral line arched over pectoral fin, then descending to midlengthwise axis and ending about opposite middle of length of anal fin base; vertical line through dorsal origin passes just behind pelvic bases; dorsal fin with a deep notch over last dorsal spine; membrane behind last soft dorsal ray attached to upper edge of caudal peduncle; anal origin under base of third from last dorsal spine; last anal ray without membranous attachment posteriorly; pectoral fins reaching a little past anus; anal spines of females small, first embedded, those of adult males with enlarged convoluted tips; posterior canines on lower jaw distinct, rather long for such a small species; teeth fine, numerous, movable, of equal size in both jaws; vomer without teeth; distal margin of caudal fin truncate; no cephalic crest.

Color in alcohol.—Background coloration whitish or light tan, with scattered small blackish pigment cells dorsally and anteriorly on body; underside of head with a V-shaped dark streak touching mouth a little in front of its rear corner; upper part of gill cover with a darkish spot, continuing ventrally as a light dusky streak across gill membranes but not quite meeting its fellow from other side; front of snout with a light dusky median streak, then below eye another light dusky streak, a third from rear of eye, all continuing and on upper lip; dorsal and caudal fins of males barred, those of females unpigmented; anal fin of males dusky distally, with tips of rays white; anal fin of female with a median row of small dusky spots on membranes; base of pectoral of males plain pale, with a narrow light dusky streak at base of rays and some more dark pigment anteroventrally.

Ecology.—This species occurs along the edges of the reefs in areas where the surf breaks, and especially in the Lithothamnium ridge, a habitat also occupied by species of *Cirripectes* and certain species of *Entomacrodus*. Our specimens are all adults and the females contain rather large pinkish eggs for such a small species.

Remarks.—This species, as indicated in the generic diagnosis, is distinguished from all other Salariinae by its low number of soft rays in dorsal and anal fins, in conjunction with the absence of vomerine teeth and of a row of cirri across the nape. No other species in the Salariinae, has so few soft rays, except in *Cirripectes*, and all members of that genus have a row of cirri across the nape.

Named *minutus* because the adults of this species are the smallest salariian blenny yet discovered.

The following key distinguishes the two species referred to the genus *Fallacirripectes:*

1*a*. Interorbital space narrow, 3 times in snout and twice in eye. **F. minutus**, new species

1*b*. Interorbital space broad, longer than snout and about equal to eye diameter ---------------------------------- **F. wellsi**, new species

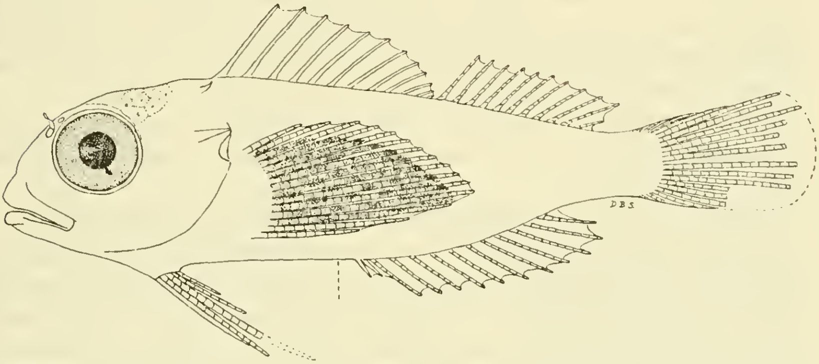

FIGURE 125.—*Fallacirripectes wellsi*, new species, holotype, USNM 142154, from Rongelap Atoll. Drawn by Dorothea B. Schultz.

FALLACIRRIPECTES WELLSI, new species

FIGURE 125

Holotype.—USNM 142154, Rongelap Atoll, *Bowditch* anchorage, half mile off Rongelap Island, July 17–27, S–46–259, Herald, 1 specimen, 11 mm. in standard length, 13.5 mm. total length; male, only known specimen.

Description.—Dorsal rays XII,11; anal II,11; pectoral 15–15; pelvics I,4–I,4; no orbital cirrus; nuchal cirrus present each side of nape; nasal cirrus present on each side.

Certain measurements were made on the types and these data are recorded below, in thousandths of the standard length, which is 11 mm.: Length of head 336; greatest depth 255, least depth of body, 91; postorbital length of head 136; diameter of eye 136; snout 100; interorbital space 109; length nasal cirrus 10; longest dorsal spine 136; longest soft dorsal ray 91; longest anal ray 109; longest pectoral ray

327; pelvics are broken; caudal with broken tips of rays; snout tip to anus 527; length from snout tip to dorsal origin 382; length of anal fin base 291.

No orbital cirrus; nuchal cirrus simple, on each side, broad based, thin, tapering abruptly to a point so that it is acutely triangular-shaped; nasal cirrus simple, short; snout profile with a forward slant of 20 to 30 degrees; edges of both lips smooth; lateral line with 6 or 7 pores about opposite upper edge of pectoral fin base, ending about ⅔ the way out length of pectoral fin; a vertical line through dorsal origin passes through pectoral base and notably behind the pelvic bases; probably no membrane attaching last dorsal ray to upper edge of caudal peduncle; anal origin opposite base of next to last dorsal spine; last anal ray without membrane attaching it to ventral edge of caudal peduncle; pectoral fins reaching to about opposite a third the way along anal fin base; the two flexible anal spines are distinct on the male holotype and tips not swollen; teeth in upper jaw flexible, numerous, those in lower jaw in Ophioblennius stage, with 2 pairs of hooked canines forward and a posterior canine on each side.

Color in alcohol.—Body plain whitish; head whitish; except dorsally brownish; middle rays of pectoral fin dark brown, upper and lower edges of fin white.

Remarks.—This new species probably is generically distinct from *F. minutus* but since *F. wellsi* is in a late Ophioblennius stage we are unable to work out sufficient characters to establish a new genus at this time. *F. wellsi* differs from *F. minutus* in having a very broad interorbital space longer than snout and about equal to eye diameter, whereas in *minutus* the interorbital space is contained about 3 times in the snout and twice in eye; *wellsi* has a dark brown pectoral fin and no dusky pigmentation on the head, whereas *minutus* has a hyaline pectoral fin, and V-shaped bars on under side of head.

Named *wellsi* in honor of Dr. John W. Wells, Geologist, who was at Bikini in 1947, and with whom I (Schultz) spent two pleasant days on the reef at Johnston Island.

Genus ALTICUS Cuvier and Valenciennes

Alticus Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 11, p. 337, 1836 (type species, *Blennius saliens* Lacepède = *Salarias alticus* Cuvier and Valenciennes).

Rupiscartes Swainson, Natural history and classification of fishes . . . , vol. 2, pp. 79, 182, 275, 1839 (type species, *Salarias alticus* Cuvier and Valenciennes).

Basilisciscartes Fowler, Not. Naturae Acad. Nat. Sci. Philadelphia, No. 26, p. 2, 1939 (type species, *Blennius saliens* Lacepède).

Since *Alticus semicrenatus* Chapman in de Beaufort and Chapman (Fishes of the Indo-Australian Archipelago, vol. 9, p. 270, 1951) has never been illustrated we are pleased to present an illustration (pl. 119, A, B, C) of the holotype.

Lacepède (p. 479. 1. c.) did not establish the genus *Alticus*. That author used the descriptive words, "Alticus saltatorius, . . ." not in the binomial sense. Thus the genus *Alticus* must date from Cuvier and Valenciennes, not Lacepède.

ALTICUS SALIENS (Lacepède)

PLATE 119,D,E,F

Blennius saliens LACEPÈDE, Histoire naturelle des poissons, vol. 2, p. 479, 1800 (type locality, New Britain; Bougainville).

SPECIMENS STUDIED

Guam: 2 lots, 5 specimens, 17 to 42 mm. in standard length.
Saipan: 1 lot, 1 specimen, 39 mm.
Tinian Island: 1 lot, 1 specimen, 33 mm.
Agrihan Island: 1 lot, 14 specimens, 21 to 37 mm.

Description.—Dorsal rays XIV,21 to 23 usually 22; anal rays II,25 to 27 usually 27; pectoral 15; no branched rays in caudal fin; pelvics I,4; orbital tentacle single, with 2 to 4 cirri on both inner and outer edges; nuchal cirrus absent; a single nasal cirrus on each nostril.

Head 4.8 to 5.2; greatest depth 6.0 to 6.4; longest pectoral ray 4.6 to 5.1; snout tip to anus 2.6 to 2.7; anal fin base 1.7 to 1.8; all in standard length. Eye 3.0 to 3.9; snout 2.2 to 2.4; postorbital length of head 1.6 to 1.7; greatest depth of body 1.2 to 1.3; least depth of body 3.0 to 3.2; longest pectoral ray 0.9 to 1.1; longest dorsal spine 2.0 (♀) to 1.0 (♂); all in length of head. Fleshy interorbital space 2.4 to 3.0 in eye.

Orbital tentacle usually with 1 or 2 cirri on inner side and 2 to 4 on outer edge of otherwise simple dermal tentacle; no nuchal cirrus; nasal cirrus simple, single, short, on upper edge of each nostril; snout profile curved or rounded with a forward slant of about 20 degrees from the vertical; edges of both lips crenulate; lateral line represented by 1 or 2 pores at upper edge of gill opening; vertical line through dorsal origin passes just behind pelvic bases; membrane on posterior side of last soft dorsal and last anal ray obsolete, not attaching to caudal peduncle; anal origin opposite base of fourth or fifth from last dorsal spine; pectoral fins reaching to anus or nearly there; anal spines small, first embedded on females but not on males; tips of anal rays not notably swollen on adult males; posterior pair of canines on lower jaw present, but small; teeth in both jaws fine, very numerous, movable; no vomerine teeth; posterior margin of caudal fin rounded; cephalic crest on adult males well developed, on adult females a low dermal fold.

Color in alcohol.—Background coloration brownish or blackish, sides sometimes with about 7 dark bars separated by 2 or 3 vertical whitish streaks; head dusky.

Ecology.—This remarkable species has not been taken on the reefs of low coral atolls, but is abundant on islands where pools occur in the lava rocks at the upper tidal level, in areas of strong wave action. There it may be seen skipping about in tiny trickles of water and ascending vertical crevices in the bare face of lava rocks to a height of 8 feet above the water in the pool. It remains out of water for a considerable length of time. Because of its nimbleness in climbing, the species is not easily captured.

Remarks.—*A. saliens* shows a certain amount of variability among the various island groups in the Indo-Pacific. We have not been able to study this variation because of lack of specimens throughout its range. Certain counts were made and these data are recorded in table 116.

Certain authors cite "*Blennius saliens* Forster, Itin. vol. 2, p. 343, 1788, type locality, Tana Island, New Hebrides" as the first use of the scientific name *Blennius saliens*. I find that no scientific name was used by George Forster in his "Journal of a Voyage Round the World . . ." (vol. 2, p. 343, 1777) when he referred to this blenny. On the page cited he refers to Hawksworth's "Account of the Voyage . . . for Making Discoveries in the Southern Hemisphere" (vol. 3, p. 529, 1773) in regard to this same blenny and in that work, too, no scientific name is applied. Neither in these or in any other publication of Forster have I found the scientific name *Blennius saliens*.

TABLE 116.—*Counts made on* Alticus saliens *from certain localities*

Locality	Dorsal rays								Anal rays			
	XIV	XV	XVI	20	21	22	23	24	II	25	26	27
Marianas Islands	18	----	----	----	3	14	1	----	18	1	16	1
Niuafoou Island	17	3	----	----	----	10	10	----	20	----	3	16
Samoan Islands	16	----	----	----	2	6	7	1	16	----	8	8
Andaman Islands	3	4	1	5	2	1	----	----	8	3	5	----

PRAEALTICUS, new genus

Type species.—*Salarias natalis* Regan.

This new genus is distinguished from all other salariian genera by the key on page 305.

Fowler (Proc. Acad. Nat. Sci. Philadelphia, vol. 98, p. 176, fig. 40, 1946) described as new from the Ryukyu Islands *Salarias schmidti* and upon examination of the holotype it was observed to be a male of *Praealticus margaritarius* (Snyder), whereas *Salarias biorni* Fowler

(1946, p. 181, fig. 45) also from the Ryukyu Islands, is a female, and likewise is a synonym of *P. margaritarius.*

Counts are recorded in table 117 for species in the genus *Praealticus.*

The two species from the Marianas Islands may be separated by means of the following key:

1*a*. Edges of both lips smooth; snout and under side of head with V-shaped dusky bars, sometimes indistinct..................**P. natalis** (Regan)

1*b*. Edge of upper lip crenulate, that of lower lip crenulate in middle two-thirds with outer sixth smooth. Snout and underside of head plain dusky.
P. amboinensis litteratus, new subspecies

Table 117.—*Counts made on certain species of* Praealticus

	Dorsal rays						Anal rays			
	XII	XIII	17	18	19	20	II	18	19	20
amboinensis amboinensis Philippines	1	10	1	6	3	1	11	4	6	1
amboinensis tanegasimae Japan		11	2	5	4		11	2	9	
amboinensis litteratus Marianas		10	1	8	1		10	4	6	
natalis Marianas	3	7	5	5			10	1	7	2

PRAEALTICUS NATALIS (Regan)

Plate 120,C

Salarias natalis Regan, Proc. Zool. Soc. London, p. 405, 1909 (type locality, Christmas Island, Indian Ocean).

SPECIMENS STUDIED

Saipan: 1 lot, 1 specimen, 33 mm. in standard length.
Guam: 3 lots, 19 specimens, 18 to 35 mm.
Rota Island: 1 lot, 10 specimens, 18 to 41 mm.
Tinian Island: 1 lot, 2 specimens, 32 to 33 mm.

Description.—Dorsal rays XII or XIII,17 or 18; anal II,18 to 20, usually II,19; pectoral 15, rarely 14, with lower 4 rays enlarged; branched caudal rays just beginning to branch at about 40 mm. standard length, adults probably with usual 5+4; pelvics I,4; orbital tentacle single, edges with numerous cirri; no nuchal cirrus; nasal cirrus single.

Head 3.7 to 4.1; greatest depth 4.8 to 5.0; longest pectoral ray 4.2 to 4.6; snout tip to anus 1.9 to 2.0; anal fin base 2.4 to 2.7; all in standard length. Eye 3.4 to 3.9; snout 2.6 to 2.8; postorbital length of head 1.5 to 1.6; greatest depth of body 1.2 to 1.3; least depth of body 2.6 to 3.0, longest pectoral ray 1.1 to 1.2, longest dorsal spine 2.0 to 2.3; all in length of head. Fleshy interorbital space 1.4 to 2.3 in eye.

Orbital tentacle, thin, very broad basally tapering to a point, edges with several to numerous short cirri, its length about ¾ eye diameter; no nuchal cirrus; nasal tentacle short and simple; snout profile rounded; with a somewhat forward slant; edges of both lips smooth; lateral line incomplete, ending opposite rear third of pectoral fin, much above midlengthwise axis; vertical line through dorsal origin passes through pectoral base and a little behind pelvic bases; dorsal fin with a deep notch over last dorsal spine; a membrane attaching last dorsal ray with upper edge of caudal peduncle but not with base of caudal fin; anal origin under base of second from last dorsal spine; last anal ray without membrane posteriorly; pectoral fins not reaching to anus, anal spines small, partly embedded in females, and first anal rays of adult males not swollen distally; posterior canine present on each side of lower jaw; teeth fine, very numerous, movable, of equal size in both jaws; distal margin of caudal fin rounded, cephalic crest of adult males well developed, as high as eye diameter, that of mature adult females very small but present.

Color in alcohol.—Background coloration whitish or light tan, with about 6 vertical light brown double bars; these more or less joined in dorsal half of body; snout with a pair of light brown streaks crossing lip and ending as a small spot at tip of chin; another light brown streak below eye across lips ending on under side of chin but not joining its fellow from opposite side; two other light brown streaks, one from under rear of eye across corner of mouth and another from behind eye across cheek, both ending on underside of head but not joining their fellow from other side; the last light brown streak extends from opercle across middle of branchiostegal rays thence continues along isthmus just behind edge of gill membranes; base of pectoral with a small brownish spot; dorsal with light brown streaks, anal plain whitish to dusky distally; midbasal part of caudal fin with a small brown spot with pale center.

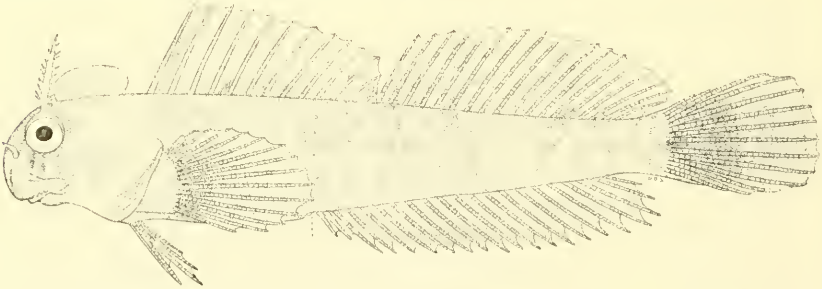

Figure 126.—*Praealticus amboinensis litteratus*, new subspecies, holotype, USNM 124116, from Guam. Drawn by Dorothea B. Schultz.

PRAEALTICUS AMBOINENSIS LITTERATUS, new subspecies

Figure 126

Holotype.—USNM 124116, Guam, Ypao Point, August 9, 1945, D. H. Johnson, standard length 41 mm., adult male.

Paratypes.—USNM 111875, Guam, Ypao Point, August 9, 1945, D. H. Johnson, 5 specimens, 38 to 47 mm.; USNM 124120, Guam, Oca Point, June 19, 1945, D. H. Johnson, 3 specimens, 27 to 31 mm.; USNM 124343, Saipan, June 1945, White, 1 specimen, 39 mm.

Description.—Dorsal rays XIII,17 to 19; anal II,18 or 19; pectoral 15 occasionally 14; tips of 2 or 3 middle caudal fin rays sometimes branched on adults; pelvics I,4; orbital tentacle over each eye; no nuchal cirrus; nasal cirrus single, simple.

Certain measurements were made on the holotype and one female paratype; these data are recorded, respectively, in thousandths of the standard length, which are 41 and 38.2 mm.: Length of head 232 and 235; greatest depth 195 and 204; least depth of body 78 and 79; postorbital length of head 165 and 141; diameter of eye 54 and 58; length of snout 95 and 84; fleshy interorbital space 17 and 26; length of orbital tentacle 129 and 58; longest dorsal spine 146 and 110; longest dorsal soft ray 159 and 131; longest anal ray 127 and 97; longest pectoral ray 210 and 215; longest pelvic ray 139 and 147; longest caudal ray 224 and 215; snout tip to anus 468 and 464; snout tip to dorsal origin 244 and 223; length of anal base 444 and 393.

Head 4.2 to 4.5; greatest depth 5.1 to 5.2; longest pectoral ray 4.3 to 4.7; snout tip to anus 2.1 to 2.2; anal fin base 2.2 to 2.3; all in standard length. Eye 3.2 to 3.9; snout 2.3 to 2.8; postorbital length of head 1.5 to 1.8; greatest depth of body 1.2 to 1.3; least depth of body 3.0 to 3.1; longest pectoral ray 1.0 to 1.1; longest dorsal spine 1.6 to 2.1; all in length of head. Fleshy interorbital space 2.5 to 3.5 in eye.

Orbital tentacle broad and thin, ribbonlike, near end tapering to a point, edges with several tiny cirri; orbital tentacle on adult males 2 to 2½ times eye diameter, on adult females only about half eye diameter; no nuchal cirrus; nasal tentacle short, simple; snout profile rounded, with a somewhat forward slant; edge of upper lip crenulate, that of lower lip crenulate in middle ⅔ with outer sixth smooth; lateral line with several pores over pectoral fin, ending about opposite ⅔ the way towards tip of pectoral fin; vertical line through dorsal origin passes through rear edge of pelvic base; dorsal fin with a deep notch over last dorsal spine; membrane behind last dorsal fin ray only basally and connecting to upper edge of caudal peduncle; anal origin under base of fourth from last dorsal spine; last anal ray without membrane posteriorly; pectoral fins almost reaching to anus; anal spines small, first embedded in females; tips of anal spines in adults not swollen; posterior canine present on each side of lower jaw; teeth fine, very numerous, movable, of equal size in both jaws; distal margin of caudal fin rounded; cephalic crest well developed in adult males, its height about half length of its base, females lack any trace of cephalic crest.

Color in alcohol.—Background coloration light tan or gray; sides with 6 or 7 double bars; base of caudal fin with a small dusky spot; upper sides sometimes with scattered brownish specks; a small dusky spot on membrane between first two dorsal spines; soft dorsal fin with oblique dusky streaks extending distally from basal dark spots corresponding with vertical dark bars; anal dusky, snout and sides of head with 4 pair of vertical light dusky bars, margined with darker edges; underside of head often with 3 V-shaped narrow dusky streaks that do not meet in midventral line, interspaces white, tip of chin sometimes dusky; adult males usually plain dusky on underside of head and vertical streaks usually replaced by plain dusky.

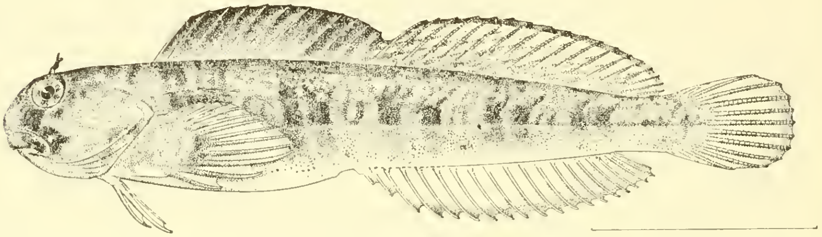

Figure 127.—*Praealticus amboinensis tanegasimae* (Jordan and Starks), holotype, USNM 53274, after Jordan and Starks.

Remarks.—This new subspecies is closest to *amboinensis* and is related to *tanegasimae* of Japan. It is distinguished from its close relatives by the following key:

1*a*. Orbital tentacle broad, thin, ribbonlike, edges with minute cirri, with 2 to 3 minute cirri forming the distal end or tip.
  2*a*. Adult females with a low dermal ridge representing the cephalic crest; underside of head usually plain dusky, rarely, even on young females, with indications of V-shaped dusky streaks; adult males with plain dusky heads and front of snout rarely showing dusky bars; figure 127. (Japan and Okinawa.)
  P. amboinensis tanegasimae (Jordan and Starks)
  2*b*. No indication of cephalic ridge or crest on adult females; underside of head usually with 3 pairs of V-shaped dusky streaks not meeting along midventral line; adult males usually with plain dusky heads; and front of snout may show dusky bars. (East Indies, Philippines.)
  P. amboinensis amboinensis (Bleeker)
1*b*. Orbital tentacle broad, thin ribbonlike, edges with minute cirri, distal end or tip tapering to a simple point; no indication of cephalic crest on adult females; underside of head usually with 3 pairs of V-shaped dusky streaks; adult males usually with plain dusky heads; ventrally and front of snout may show dusky bars. (Marianas Islands.)
P. amboinensis litteratus, new subspecies

Subfamily BLENNIINAE

By LEONARD P. SCHULTZ

The number of specimens from the Marshall Islands belonging to this subfamily of blennies was not an adequate basis for a detailed study. The specimens have been identified with considerable care, but with no monograph on this group available for reference, some names older than the ones used may exist. My search of the literature reveals nearly one hundred species that have been described and referred to this subfamily, but descriptions of several of these species are so inadequate that they cannot be referred to any genus with certainty.

I am unable to identify one small specimen, 11 mm. in standard length, from Eniwetok Atoll. It is just passing from the Ophioblennius to the adult stage, being farther along in the latter.

Norman (Ann. Mag. Nat. Hist., ser. 11, vol. 10, pp. 796–806, 1943) is followed in regard to recognition of genera, with the exception of *Aspidontus*, which I have divided into two genera on the basis of the characters given in the following key (modified after Norman):

1*a*. Dorsal rays XI or XII,13 to 15; anal II,14 to 17; depth of body 3 to 3½ in standard length; interorbital width ½ to ⅔ diameter of eye; gill opening entirely above base of pectoral fin; incisorlike teeth of both jaws about equal in number, or about 20 to 34 in each jaw_ **Petroscirtes** Rüppell

1*b*. Dorsal rays IV to XII,17 to 38; anal II,16 to 32, depth of body 4 to 7½ in standard length; interorbital width in adults nearly equal to or greater than diameter of the eye.

  2*a*. Gill opening extending downwards in front of the base of pectoral fin rays; dorsal fin soft rays 26 to 38, anal soft rays 22 to 32.

    3*a*. Pectoral rays normally 14; incisorlike teeth of lower jaw approximately equal in number and in size to those of upper jaw. **Aspidontus** Quoy and Gaimard

    3*b*. Pectoral rays normally 12; incisorlike teeth of lower jaw approximately twice or nearly twice as numerous and about half as wide as those in upper jaw_____________________ **Runula** Jordan and Bollman

  2*b*. Gill opening entirely above the base of the pectoral fin; dorsal soft rays 17 to 28; anal soft rays 15 to 20.

    4*a*. Upper profile of head descending steeply, the snout shorter than eye; dorsal fin with IV to VIII spines; anterior edge of the lower jaw transversally rounded____________________ **Meiacanthus** Norman

    4*b*. Upper profile of the head not steep, often nearly horizontal, snout as long as or longer than eye; dorsal fin with about XI spines; anterior edge of the lower jaw transversely truncate. **Dasson** [15] Jordan and Hubbs

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[15] Not yet found in northern Marshall Islands.

Genus PETROSCIRTES Rüppell

Petroscirtes Rüppell, Atlas zu der Reise im nördlichen Afrika . . ., Fische des rothen Meers, vol. 4, p. 110, 1828 (type species, *Petroscirtes mitratus* Rüppell).

PETROSCIRTES MITRATUS Rüppell

Plate 120,A

Petroscirtes mitratus Rüppell, Atlas zu der Reise im nördlichen Afrika . . ., Fische des rothen Meers, vol. 4, p. 111, pl. 28, fig. 1, 1828 (type locality, Red Sea).

SPECIMEN STUDIED

Eniwetok Atoll, Ebiriru Island, August 8, 1949, Univ. of Washington, 1 specimen, 27 mm. standard length.

Description.—Dorsal rays XI,14; anal II,14; pectoral 14–14, pelvics I,3–I,3, no branched caudal rays; underside of head with two pairs of broad thin dermal cirri; teeth in jaws about 32 above and 32 below; gill opening does not extend down in front of any of the pectoral rays; eye with a dermal cirrus; other dermal cirri on rim of bony orbit.

Head 3.2; greatest depth 3.8; longest pectoral ray 4.8; snout tip to anus 1.8; all in standard length. Eye 2.7; snout 3.4; postorbital part of head 2.3; least depth of body 2.6; greatest depth 1.25; length from snout tip to rear of mouth, or rictus 4.0; width of gill opening 6.5; longest dorsal spine (second) 1.5; all in length of head. Bony interorbital space in eye 2.7. Eye in snout 0.8.

Lips without folds; canines in both jaws greatly enlarged; teeth of jaws firm, immovable, of equal size in both jaws; dentigerous edge of both jaws transversely rounded; mouth subterminal, snout scarcely in front of toothed part of upper jaw; anterior nostrils tubular, posterior nostrils in a raised rim; distance between pair on each side contained about 10 times in eye; rear nasal pore a little in front of a vertical line at front of eye; vertical line through dorsal origin passes about one-half a pupil diameter behind eye; eighth or ninth pectoral ray from dorsal edge longest; gill opening not quite as wide as pupil of eye, not extending below dorsal edge of pectoral fin base; first and second dorsal rays a little longer than fourth or fifth; last ray of both dorsal and anal fins membranously attached to caudal peduncle; lateral line present, incomplete, ending a little in front of a vertical line through first soft dorsal ray.

Color in alcohol.—Background coloration light dusky, with some whitish blotches dorsally; dorsal fin with indications of about 6 dusky bars; a few dusky spots on base of pectoral; at base of outer or first pelvic ray is a dusky spot; dermal cirri dusky.

Remarks.—Additional counts were made on 5 specimens of *P. mitratus* from the Philippine Islands as follows: Dorsal rays XI,15; XII,14; XI,15; XI,15; and XII,13. Anal II,16; II,14; II,15; II,15;

and II,14. Pectoral rays 14–14; 15–15; 15–15; 14–14; and 14–15. Pelvics always I,3. Teeth in both jaws varied from 30 to 34.

Genus ASPIDONTUS Quoy and Gaimard

Aspidontus Quoy and Gaimard, Voyage de . . . l'*Astrolabe* . . . , Zoologie, vol. 3, p. 719, pl. 19, fig. 4, 1834 (type species, *Aspidontus taeniatus* Quoy and Gaimard).

Counts are recorded in table 118 for certain species in this genus.

KEY TO THE SPECIES OF ASPIDONTUS FOUND IN THE MARSHALL ISLANDS

1*a*. Gill opening extending down to lower edge of base of pectoral fin; first rays of spiny dorsal notably elongate; dark streaks from eye along middle of sides..............**A. filamentosus** [16] (Cuvier and Valenciennes)

1*b*. Gill opening not extending beyond base of eleventh pectoral ray, counting from dorsal edge; first rays of spiny dorsal fin not notably elongate.

  2*a*. Gill opening extends to opposite bases of pectoral rays 5 to 8; an intensely black lateral band from snout tip through eye, broadening posteriorly, sharply contrasting with pale above and below, or band faded and with only the dark edges showing behind eye. **A. taeniatus** Quoy and Gaimard

  2*b*. Gill opening extends to opposite base of pectoral rays 9 to 11; background coloration light brown usually with 8 or 9 vertical dark brown bars that continue on both dorsal and anal fins, dark bars separated by paler interspaces..........................**A. fluctuans** (Weber)

ASPIDONTUS TAENIATUS Quoy and Gaimard

PLATE 106,F

Aspidontus taeniatus QUOY and GAIMARD, Voyage de . . ., l'*Astrolabe* . . . , Zoologie, vol. 3, p. 719, pl. 19, fig. 4, 1834 (type locality, Guam; northern Guinea).

Petroscirtes taeniatus GÜNTHER, Journ. Mus. Godeffroy, vol. 4, pt. 13, p. 195, pl. 114, fig. A, 1877 (Tahiti).

Petroscirtes azureus JORDAN and SEALE, Bull. U. S. Bur. Fish, vol. 25 (1905), p. 432, fig. 109, 1906 (type locality, Apia, Samoa).

SPECIMENS STUDIED

Bikini Atoll: 3 stations, 4 specimens, 47 to 85 mm. in standard length.
Rongerik Atoll: 1 station, 2 specimens, 82 to 90 mm.

Description.—Dorsal rays XI,27 or 28, anal II,25; pectoral 14; pelvics I,3; no branched caudal ray; under side of mouth with 3 to 5 dermal tentacles; small teeth in lower jaw 25 or 26; gill opening extends down in front of base of 5th to 7th pectoral fin ray.

Head (measured from tip of anteriormost projection of snout to rear of fleshy gill cover) 3.9; greatest depth 5.1 to 6.0; longest pectoral ray 6.9 to 7.0; snout tip to anus 2.1; all in standard length. Eye 4.7 to 4.8; snout 3.0 to 3.1; postorbital part of head 2.0; least depth of body 2.3 to 2.5; greatest depth 1.3 to 1.4; length from snout tip to rear of mouth or rictus 3.5 to 3.6; width of gill opening 4.4 to 4.6;

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[16] Not yet collected in Marshall Islands.

TABLE 118.—*Counts made on certain species of* Aspidontus *and* Runula

Species	Incisorlike teeth																																						
	Lower jaw																										Upper jaw												
	15 16	17 18	19 20	21 22	23 24	25 26	27 28	29 30	31 32	33 34	35 36	37 38	39 40	41 42	43 44	45 46	47 48	49 50	51 52	53 54	55 56	57 58	59 60	61 62	63 64	65 66	17 18	19 20	21 22	23 24	25 26	27 28	29 30	31 32	33 34	35 36	37 38	39 40	41 42
A. fluctuans																																							
Marshall Islands	---	6	---	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1	2	2	---	---	---	---	---	---	---	---	---	---
Philippine Islands	2	1	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1	1	---	---	---	---	---	---	---	---	---	---	---
A. taeniatus	---	---	---	---	---	5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	2	---	---	---	---	---	---	---	---
A. filamentosus	---	1	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1	---	1	---	---	---	---	---	---	---	---	---	---
R. ringens	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	2	1	---	---	---	---	---	---	---	---	---	1	---	---	2	---	---	---	---	---
R. azalea	---	---	---	---	---	---	---	---	---	---	---	---	---	1	2	1	---	1	---	---	---	---	---	---	---	---	---	---	1	2	---	---	---	---	---	---	---	---	---
R. tapeinosoma	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1	---	2	---	---	2	---	---	---	---	1	---	1	2	1	---	---	---	---
R. ewaensis	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1	1	---	---
R. rhinorhynchos	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1	---	1	1	---	---	---	---	---	---	---	---	---	---	---	---	1	---	---	1	1

Species	Fin rays																													Gill opening extends down in front of bases of pectoral rays (counting from dorsal edge)										
	Dorsal																Anal										Pectoral														
	VII	VIII	IX	X	XI	27	28	29	30	31	32	33	34	35	36	37	II	25	26	27	28	29	30	31	32	33	11	12	13	14	4	5	6	7	8	9	10	11	12	13	14
A. fluctuans																																									
Marshall Islands	---	---	1	6	---	---	---	---	2	4	1	---	---	---	---	---	6	---	---	1	5	---	---	---	---	---	---	---	---	8	---	---	---	---	---	1	2	1	---	---	---
Philippine Islands	---	---	---	4	1	1	1	1	1	1	---	---	---	---	---	---	5	---	3	1	1	---	---	---	---	---	---	---	---	7	---	---	---	---	---	---	2	3	---	---	---
A. taeniatus	---	---	---	---	5	4	1	---	---	---	---	---	---	---	---	---	5	4	1	---	---	---	---	---	---	---	---	---	---	6	---	1	2	1	1	---	---	---	---	---	---
A. filamentosus	---	---	---	---	2	1	---	1	---	---	---	---	---	---	---	---	2	---	1	---	1	---	---	---	---	---	---	---	---	4	---	---	---	---	---	---	---	---	---	---	4
R. ringens	1	4	1	---	---	---	---	---	---	1	1	1	1	2	---	---	5	---	---	2	2	1	---	---	---	---	---	3	1	---	---	1	1	1	---	---	---	---	---	---	---
R. azalea	1	5	---	---	---	---	---	---	---	1	---	1	3	1	---	---	5	---	---	---	1	3	1	---	---	---	---	8	---	---	1	2	---	---	---	---	---	---	---	---	---
R. tapeinosoma	---	5	---	---	---	---	---	---	---	---	---	---	---	---	4	1	5	---	---	---	---	3	2	---	---	---	1	8	---	---	1	1	1	---	---	---	---	---	---	---	---
R. ewaensis	---	---	---	---	2	---	---	---	---	---	---	---	---	1	1	---	2	---	---	---	---	---	---	---	1	1	---	4	---	---	2	---	---	---	---	---	---	---	---	---	---
R. rhinorhynchos	---	---	---	---	3	---	---	---	---	---	1	1	1	---	---	---	3	---	---	---	---	---	2	---	---	1	---	4	2	---	1	1	---	---	---	---	---	---	---	---	---

longest dorsal spine 2.5 to 2.7; all in length of head. Bony interorbital space 0.8 to 0.9 in eye. Eye 1.4 in snout.

Lips without folds; lower canines greatly enlarged, those of upper jaw in one pair and very small, concealed by lips; teeth of jaws firm, immovable, of equal size in both jaws; dentigerous edge of both jaws transversely rounded; mouth inferior, snout notably projecting; both posterior and anterior pair of nostrils low tubes, distance between pair on each side contained about 2.8 in eye, rear nasal pore just in front of a vertical line through front of eye; vertical line through dorsal fin origin passes about one pupil diameter behind eye; eighth or ninth pectoral rays from dorsal edge longest; gill opening wider than diameter of eye, and the opening extending a little farther in front of bases of pectoral fin rays than above pectoral fin base; both last rays of dorsal and anal fins membranously attached to caudal peduncle but not to caudal fin; lateral line present, incomplete, with a few irregular pores, the last about opposite tips of pectoral fin, this series of pores close to base of dorsal fin.

Color in alcohol.—The most distinctive coloration is a black lateral band (sometimes faded), from under tip of snout through eye along sides to caudal fin, broadening posteriorly, this dark streak on head has black edges, with paler center of light brown; ventral part of body pale or light dusky; anterodorsal part of body pale; dorsal and anal fins dusky or blackish with white edge; caudal fin blackish except edges are white, including posterior edge.

Color when alive.—The pale ventral part of head and body light yellowish orange anteriorly, changing to bright bluish posteriorly; the pale dorsal area light purplish red, changing to blue posteriorly; the paler central area of dark streak on head reddish brown; the dark streak black; and front of base of pectoral fin at lower edge with a trace of a light brownish blotch.

Ecology.—This species was found on the lagoon and ocean reefs among coral and algal growths. A female from the Philippines contained numerous small eggs, almost mature.

Remarks.—Jordan and Seale in their original description did not compare *azureus* with *A. taeniatus* Quoy and Gaimard with which it is identical. The specimens of *A. taeniatus* before me are alike in coloration but differ a little from the illustrations of *A. taeniatus* in Quoy and Gaimard and in Günther; they have a white posterior margin on the caudal fin that is lacking in both plates. The white distal edge of the caudal fin becomes broader with increase in size. In the smaller specimens the caudal fin is black, except the tips of the rays may be white. The two plates do not show barbels under the chin, but distinct barbels are present on all of our male specimens except one, which is immature. The females lack barbels, except a rudimentary one occurs on the large female.

The holotype of *Petroscirtes azureus* Jordan and Seale has been re-examined. It has the white edge all the way around the rear margin of the caudal fin as in the other three specimens at hand; the dorsal rays are XI,27; anal II,28; pectoral 14; pelvics I,3; there are 7 or 8 barbels on under side of head; and the teeth in the lower jaw number 25.

Aspidontus tractus Fowler (Proc. Acad. Nat. Sci. Philadelphia, p. 170, pl. 7, 1903) from Zanzibar, with a black bar on the pectoral base, is a distinct species.

ASPIDONTUS FLUCTUANS (Weber)

Petroscirtes fluctuans Weber, Notes Leyden Mus., vol. 31, pp. 146–147, 1909 (type locality, between Gebe and Fau Islands; Banda Sea); *Siboga*-Expeditie, vol. 57, p. 541, fig. 113, 1913 (on types).

Petroscirtes quadrimaculatus Kendall and Goldsborough, Mem. Mus. Comp. Zool. vol. 26, No. 7, p. 329, pl. 7, fig. 1, 1911 (type locality, Arno Atoll, Marshall Islands; Papeete, Tahiti, Society Islands).

SPECIMENS STUDIED

Bikini Atoll: 2 stations, 3 specimens, 41 to 42 mm. in standard length.

Rongerik Atoll: 1 station, 2 specimens, 41 and 42 mm.

Arno Atoll: 2 lots, 2 specimens, 35 and 41 mm., USNM 65981, paratype, and USNM 65980, holotype, of *P. quadrimaculatus* Kendall and Goldsborough.

Description.—Dorsal rays IX or X,30 to 32; anal II,27 or 28; pectoral 14; pelvics I,3; no branched caudal fin rays; no tentacles; small or incisorlike teeth in lower jaw about 15 to 21 and upper jaw about 18 to 21; 2 small canines each side of upper jaw, 1 enlarged canine each side of lower jaw; gill opening extending down in front of bases of 9 or 10 pectoral rays.

Head (tip of anteriormost projection of snout to rear of fleshy gill cover) 4.0 to 4.1; greatest depth 6.0 to 6.1; longest pectoral ray 7.4 to 7.5; snout tip to anus 2.1; all in standard length. Eye 3.7 to 4.0; snout 3.4 to 3.7, postorbital part of head 2.0 to 2.1; least depth of body 3.1 to 3.3; greatest depth 1.5 to 1.6; length from snout tip to rear of mouth or rictus 4.2 to 4.3; width of gill opening 3.6 to 3.9; longest dorsal spine 2.3 to 2.4; all in length of head. Bony interorbital space 0.9 in eye. Eye 1.0 in snout.

Lips without folds; lower canines greatly enlarged, those of upper jaw small, usually 2 on each side, mostly concealed by lips; teeth in both jaws, firm, immovable, of equal size; dentigerous edge of both jaws transversely rounded; mouth nearly terminal; rounded snout projecting a little in front of mouth; both anterior and posterior nostrils with low tubes, the anterior one longest and with a short tentacle arising from the posterior edge, distance between each pair of nostrils on each side about 3½ to 4 in eye; rear nostril over front edge of eye; vertical line through dorsal fin origin passes about 2 pupil diameters behind eye, or a little closer to eye than rear of head; eighth or ninth pectoral ray from dorsal edge longest; gill opening about equal to diameter of eye, the opening extending much farther down in front of pectoral base than above it; last rays of both dorsal and anal fins membranously attached to caudal peduncle but not to caudal fin; lateral line present, incomplete, with several pores close to base of dorsal fin, and ending about opposite tips of pectoral rays; caudal fin truncate or nearly so posteriorly.

Color in alcohol.—Background coloration light brown usually with 8 or 9 vertical dark brown bars that continue on both dorsal and anal fins, these dark bars separated by somewhat narrower pale interspaces; middle of side with a lengthwise dark streak from behind eye, prominent in one pale specimen on which the dark bars are obscure, and on other specimens obsolete, except for the holotype of *quadrimaculatus*, which has the dark bars intensified on the midsides to form a broken dark streak; pectoral and pelvic fins pale; caudal fin pale except dark brown coloration of body ends on central part of base of caudal fin with a rounded posterior edge; in the non-barred color phase the median fins are blackish.

Ecology.—Four of the specimens listed from the northern Marshall Islands were attracted to a light at night and caught at the surface in a dipnet, whereas a single specimen, with a dark lateral streak, was taken from the lagoon reef, around coral heads and beach rock, where there was an abundance of loose sand.

Remarks.—We have compared the 7 specimens from the Marshall Islands with 5 from the Philippines and find them very similar in color pattern, but the soft rays of both dorsal and anal fins average about one ray less in the Philippine specimens than in the Marshall Islands ones. Since there is some variability, we do not believe it advisable to describe the Philippine specimens as a new subspecies at this time on only a few specimens.

Genus RUNULA Jordan and Bollman

Runula Jordan and Bollman, Proc. U. S. Nat. Mus., vol. 12, p. 171, 1890 (type species, *Runula azalea* Jordan and Bollman, holotype, USNM 44299, Galapagos).

Atopoclinus Vaillant, Bull. Soc. Philomath. Paris, ser. 3, vol. 6, p. 73, 1890 (type species, *Atopoclinus ringens* Vaillant).

In a short paper I (Journ. Washington Acad. Sci., vol. 40, No. 8, p. 266, 1950) pointed out that *Runula* was a genus distinct from *Aspidontus*. The counts made on specimens in the U. S. National Museum of the various species referable to these genera are recorded in table 118. Several other species referable to these genera were not studied by me.

RUNULA TAPEINOSOMA (Bleeker)

PLATE 120,B

Petroskirtes tapeinosoma BLEEKER, Act. Soc. Sci. Indo-Néerl., vol. 2, p. 64, 1857 (type locality, Amboina in Sea).

SPECIMENS STUDIED

Rongelap Atoll: 2 stations, 3 specimens, 45 to 58.5 mm. in standard length.
Kwajalein Atoll: 1 station, 2 specimens, 39 and 53 mm.

Description.—Dorsal rays VIII,36 or 37; anal II,29 or 30; pectoral usually 12, occasionally 11; no branched caudal ray; no tentacles on eye; under side of lower jaw with or without 4 barbels; small incisorlike teeth in lower jaw about twice as numerous as those in upper jaw (55 to 66 in lower and 25 to 34 in upper); no developed canine in upper jaw, but last 1 or 2 of the lateral teeth may be pointed at tips, canine at each side of lower jaw enormous; gill opening extending down in front of bases of 4 to 6 pectoral rays.

Head (tip of anteriormost projection of snout to rear of fleshy gill cover) 4.2 to 4.8; greatest depth 7.5 to 8.4; longest pectoral ray 8.6 to 9.1; snout tip to anus 2.3 to 2.5; all in standard length. Eye 3.5 to 4.0; snout 3.4 to 3.6; postorbital length of head 2.0 to 2.1; least depth of body 2.8 to 3.3; greatest depth 1.7 to 1.8; length from snout tip to rear of mouth or rictus 2.6 to 2.8; width of gill opening 6.3 to 7.3; longest dorsal spine 1.9 to 2.5; all in length of head. Bony interorbital space 1.0 in eye. Eye 1.0 to 1.1 in snout.

Lips without folds; lower canines greatly enlarged, those of upper jaw small, represented by 1 or 2 pointed teeth, scarcely caninelike, mostly concealed by lips; teeth in both jaws firm, immovable, those of lower jaw notably much smaller than in upper jaw and about twice more numerous; dentigerous edge of both jaws transversely a little rounded; mouth subterminal, snout notably projecting; nasal openings with low rim, distance between nasal openings on one side about 2 in eye; rear nostril over front edge of eye; vertical line through dorsal fin origin passes about 2 pupil diameters behind eye, and a little closer to rear of head than eye; sixth pectoral ray from dorsal edge longest; gill opening about ⅔ diameter of eye, the opening a little farther down in front of pectoral fin base than above it; last rays of both dorsal and anal fins membranously attached to caudal peduncle but not to caudal fin; lateral line absent; posterior margin of caudal fin concave or forked.

Color in alcohol.—Background coloration of lower half head and body pale or white, with a brownish lateral streak broken in about 23 or 24 short dark brown bars that end as they meet a white line that extends from front of snout across dorsal edge of eye, thence along upper side and ending on upper side of caudal peduncle; a short white middorsal line extends from interorbital space to dorsal origin; the dark brown lateral streak continues on caudal fin on middle ray as a narrow black line; outer third of dorsal fin blackish with edge white; anal dusky edged with white; pectoral and pelvics hyaline; caudal white, except for median black streak; underside of snout white.

Ecology.—All of our specimens came from the lagoon reefs where coral heads were not very numerous and the bottom between the coral heads was composed of loose "coral" sand.

Genus MEIACANTHUS Norman

Meiacanthus Norman, Ann. Mag. Nat. Hist., ser. 11, vol. 10, p. 805, 1943 (type species, *Petroscirtes oualensis* Günther).

MEIACANTHUS ATRODORSALIS (Günther)

Plate 120,D

Petroscirtes atrodorsalis Günther, Journ. Mus. Godeffroy, vol. 4, pt. 13, p. 198, pl. 115, fig. B, 1877 (type locality, Samoa).

Specimens studied.—Rongelap Atoll, Rongelap Island, lagoon coral head, depth 18 feet, July 25, S–46–286, Brock, Herald and Kohler, 3 specimens, 46 to 54 mm. in standard length; Rongelap Atoll, Tufa Island, depth 28 feet, July 29, S–46–300, Herald and Brock, 1 specimen, 65 mm.; Rongelap Atoll, Naen Island, depth 10 feet, July 30, S–46–302, Herald, 1 specimen, 35 mm.

Description.—Dorsal rays IV,26 or 27; anal II,16 or 17, usually II, 17; pectoral 14 or 15, usually 15; pelvics I,3; a pair of tentacles on underside of head present or absent; no tentacles on eye; small incisorlike teeth in lower jaw about same number and size as in upper jaw or 20 to 22 in both jaws; a small canine on each side of upper jaw, separated from incisorlike teeth by a deep edentulous notch; canine each side of lower jaw enormous in size compared with upper one; gill opening extending to opposite upper edge of base pectoral fin.

Head (tip of most anterior projection of snout to rear edge of fleshy gill cover) 3.6 to 4.7, greatest depth 3.6 to 4.9; longest pectoral ray 5.5 to 7.3; snout tip to anus 2.0 to 2.1; all in the standard length. Eye 3.1 to 3.7; snout 3.3 to 3.7; postorbital length of head 2.0 to 2.1; least depth of body 2.1 to 2.7; greatest depth 1.1; length from snout tip to rear of mouth or rictus 3.2 to 3.8; width of gill opening 4.9 to 6.0; longest dorsal spine 1.8 to 1.9; all in length of head. Bony interorbital space 1.1 to 1.5 in eye. Eye 0.8 to 1.1 in snout.

Lips without folds; lower canines greatly enlarged, those of upper jaw small, represented by short curved canine on each side, covered by lip; teeth in both jaws firm, immovable, of equal size and number in both jaws; dentigerous edge of both jaws much rounded; mouth subterminal, snout but slightly in front of mouth; nasal openings small, anterior with a very short tube, posterior nasal opening difficult to locate, a vertical line through front of eye passes about through it on top of head; vertical line through dorsal fin origin passes from 1 to 1½ pupil diameters behind eye, or a little closer to rear edge of eye than to gill opening; eighth or ninth pectoral ray from dorsal edge of eye longest; gill opening about ⅔ diameter of eye and not extending below upper edge of base of pectoral fin; last rays of both dorsal and anal fins membranously attached to caudal peduncle but not to caudal fin; lateral line with a few pores near base of spiny dorsal fin, ending about opposite tips of pectoral fin; posterior margin of caudal deeply concave, the outer rays, both dorsally and ventrally greatly elongate and filamentous, those of the largest specimen 3½ times longer than head.

Color in alcohol.—Background coloration plain brownish anteriorly fading posteriorly so that posterior third is white; caudal fin white; pectoral fin hyaline, with a dark brown spot as large as eye on rear base of pectoral; dorsal fin pale distally, basally with a brown band fading posteriorly so that rear quarter of dorsal fin is white or hyaline; pelvics a little dusky; tentacles on under side of head, if present, usually brownish; peritoneum black.

Ecology.—This rare species was taken from coral heads separated by sandy areas in water of depths from 10 to 28 feet, well below the intertidal zone.

Suborder OPHIDINA

Family BROTULIDAE

By Leonard P. Schultz

All counts were made after the skin had been dissected from one side of the fins and each ray with a separate base was counted as one ray.

The following key is intended to separate the three genera found in the northern Marshall Islands and in Guam:

1*a*. Head with three pairs of barbels on snout and three pairs on chin; dorsal and anal fins continuous with caudal fin________________ **Brotula** Cuvier
1*b*. No barbels on head; caudal fin separate.
  2*a*. Maxillary concealed by dermal fold along lower edge of cheek when mouth is closed; depth of body, one head length in front of base of caudal fin, 3 in length of head________________ **Brosmophyciops**, new genus
  2*b*. Posterior lower part of maxillary exposed when mouth is closed; depth of body, one head length in front of base of caudal fin, about half in length of head________________________________ **Dinematichthys** Bleeker

Subfamily BROTULINAE

Genus BROTULA Cuvier

Brotula Cuvier, Régne animal, ed. 2, vol. 2, p. 335, 1829 (type species, *Enchelyopus barbatus* Bloch and Schneider).

Gosline (Copeia No. 4, pp. 215–218, figs. 1a–b, 1953) has shown for the central tropical Pacific that two species of shallow water brotulids must be referred to the genus *Brotula.* These may be distinguished by the following key, modified after Gosline:

1*a*. Anal rays 100 to 111; dorsal rays 121 to 145; eye diameter equal to or greater than width of fleshy interorbital; median fins with a narrow white border, blackish submarginally; lips dark, chin white except dark tip; plate 121,D.................... **B. multibarbata** [17] Temminck and Schlegel

1*b* Anal rays 71 to 84; dorsal rays 100 to 105; eye diameter less than width of fleshy interorbital; median fins greenish brown basally, with a broad orange border when alive; lips and chin greenish brown. **B. townsendi** Fowler

BROTULA TOWNSENDI Fowler

Brotula townsendi Fowler, Proc. Acad. Nat. Sci. Philadelphia, 1900, p. 518, pl. 20, fig. 3, 1901 (type locality, Sandwich Islands).

SPECIMENS STUDIED

Bikini Atoll: 1 station, 1 specimen, 168 mm. in standard length.
Arno Atoll: 1 lot, 1 specimen, 91 mm. collected by Dr. Strasburg.

Description.—The following description is based on two specimens, the one from Bikini Atoll and another, 104 mm., from Johnston Island. Dorsal rays (each ray with separate base is counted as one ray) 103 and 105; anal 84 and 81; pectoral 25; scales 133; pelvics ii; branched caudal rays 5+5 and 5+4. Greatest depth 4.3 to 5.0, head 4.1 to 4.2; length of pectoral fin 8.2; length of pelvic fin 5.5; length of caudal fin 11.5 to 15; all in standard length. Eye 6.9 to 7.2; snout 4.0 to 4.5; pectoral fin 2.0 to 2.1; caudal fin 2.7 to 3.8. Greatest depth 1.1 to 1.2; interorbital space 5.1; length of mouth 1.8; all in the length of the head.

Head rounded; body compressed posteriorly; head a little smaller than body; a vertical line through dorsal origin passes just behind pectoral base and one eye diameter behind head; anal origin a little closer to tip of snout than base of caudal fin; dorsal and anal fins composed of soft rays only, continuous with caudal fin; pectoral fins rounded; caudal rounded; scales cycloid, small, thin, extending on basal half (or more) of dorsal, anal, caudal, and pectoral fins; pelvic fins composed of two simple rays, inserted forward on isthmus, before pectoral bases; maxillary slipping under a sheath below eye, except its rear tip; eye small, without free margin; three pairs of barbels on snout and three pairs on chin; nasal openings two on each side, one of the barbels on snout arising from rear side of anterior nasal opening; teeth villiform, in a band on both jaws and on palatines, those on vomer in a V-shaped villiform band.

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[17] *Brotula multibarbata* Temminck and Schlegel, Fauna Japonica, pp. 251-253, pl. 111, fig. 2, 1846 (type locality, Simabara Bay, Japan).

Color in alcohol.—Plain light brownish; fins dusky; lips dark brownish.

Ecology.—This species was taken on the reef in shallow water.

Remarks.—Hubbs (Copeia, No. 3, pp. 162–178, figs. 1, 2, 1944) revised the genus *Brotula* and recognized three species. One of these, *multibarbata*, he limited to the tropical Indo-Pacific and in its synonymy he placed 12 named species. Although at the time that seemed the best approach because of limited material available, the problem of speciation in the vast Indo-Pacific is not yet settled. The data presented by Hubbs and by Gosline and that on the two specimens described herein indicate that the problem at least needs further study. Hildebrand and Barton (Smithsonian Misc. Coll., vol. 111, No. 11, pp. 25–28, fig. 7, 1949) described a new species of *Brotula* from Talara, Peru, which is unlike *multibarbata* or *townsendi* in having, among other characters, the dorsal origin in front of pectoral base.

Brotula maculata Day (Proc. Zool. Soc. London, p. 196, 1868, type locality, Madras) may be a distinct species, as its described color does not agree with *multibarbata* or *townsendi*, and it has an intermediate number of fin rays, dorsal 115, anal 107.

Subfamily BROSMOPHYCINAE

BROSMOPHYCIOPS, new genus

Type species.—*Brosmophyciops pautzkei*, new species.

Caudal fin separate from dorsal and anal fins; maxillary concealed by dermal fold of cheek; no barbels; scales on body imbricated, none on head; eyes present, moderately large; opercular spine, short, stout; no preopercular spine; lateral line obsolete or absent; lower jaw a little included; pectoral rounded, middle rays longest; pelvic rays ii, closely adhering and appearing as a single ray; a single short, blunt, pyloric caecum on each side of pylorus; a vertical line through dorsal origin passes a little way behind pectoral base; anus slightly closer to tip of snout than base of caudal fin.

This new genus was proposed after considerable study of the various genera and species referable to the brotulid subfamily, *Brosmophycinae*. This subfamily as herein understood includes a group of genera in which barbels are lacking, the caudal fin is distinct and separate from the dorsal and anal fins, and the males have a spiny copulatory organ. I have experienced much difficulty in diagnosing the genera recognized, largely because of inadequate descriptions and figures, and because of the lack of specimens of certain Australian genera. At least three phyletic lines are more or less indicated by body form: One, represented by the genus *Dinematichthys*, in which the body is robust, so that the dorsal and ventral contours of the body are convex between the caudal fin base and a point a head length anterior to it; a second, containing the blind genera, which are also somewhat robust, but in which the dorsal and ventral contours are nearly straight and the body more slender in that region; and a third, represented by a group of genera with slender bodies, centering around *Brosomophycis*, in which the dorsal and ventral contours of the body are slightly concave in that region. To this latter group I refer the new genus and probably the genera *Monothrix* and *Dermatopsis*. These differences are not very clear cut but are sufficiently distinct to indicate differences in body form among the genera. *Brosmophyciops* differs from all other genera in the subfamily *Brosmophycinae* in having the maxillary concealed when the mouth is closed. The following key to the genera of *Brosmophycinae* with caudal fin separate from dorsal and anal fins, and with males having a spiny copulatory organ, is tentative, but it should enable the separation of the various genera related to the new genus:

1*a*. Blind, eyes not visible externally------------------Lucifuga[18] Poey
Stygicola Gill
Typhlias Hubbs

1*b*. Eyes normally developed, visible externally.
  2*a*. Gill rakers all tuberculate, none at angle of first gill arch distinctly elongate; scales imbricate, at least posteriorly; opercular spines 2, lower one very short, concealed; dorsal rays about 102 or 103; anal about 78 to 86------------------Monothrix[19] Ogilby
  2*a*. At least one gill raker at angle and two more next to it on lower part of first gill arch, notably longer than others, which are tuberculate.
    3*a*. Scales not imbricate, rudimentary, distinctly separated from each other------------------Dermatopsis[20] Ogilby

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[18] *Lucifuga* Poey, Memorias sobre la historia natural de la isla de Cuba, vol. 2, p. 95, 1860 (type species, *L. subterranus* Poey).

Stygicola Gill, Proc. Acad. Nat. Sci. Philadelphia, vol. 15, p. 252, 1863 (type species, *Lucifuga dentatus* Poey).

Typhlias Hubbs, Carnegie Inst. Washington Publ. No. 491, p. 287, 1938 (type species, *T. pearsei* Hubbs).

[19] *Monothrix* Ogilby, Proc. Linn. Soc. New South Wales, vol. 22, p. 87, 1897 (type species, *M. polylepsis* Ogilby).—Whitley, Rec. Austr. Mus., vol. 19, p. 241, fig. 9, 1935.

Diagnosis based on descriptions only. On the basis of their having tuberculate gill rakers, *Dermatopsis multiradiatus* McCulloch and Waite (Rec. South Australian Mus., vol. 1, p. 63, pl. 5, fig. 4, 1918) and *Dermatopsis kasougae* Smith (Trans. Roy. Soc. South Africa, vol. 30, p. 72, fig. 3, 1943) are with much uncertainty referred to this genus.

[20] *Dermatopsis* Ogilby, Proc. Linn. Soc. New South Wales, vol. 21, p. 138, 1896 (type species, *D. macrodon* Ogilby).—Whitley, Rec. Austr. Mus., vol. 19, p. 239, 1935.

Diagnosis based on description only.

3*b*. Scales imbricate on body.
  4*a*. At least two-thirds of posterior part of maxillary exposed, not covered by dermal fold of cheek when mouth is closed.
    5*a*. One short, blunt pyloric caecum on each side of pylorus; head finely ciliate, without scales ---------**Brosmophycis**[21] Gill
    5*b*. No pyloric caecum developed (only a thickening in the wall where it might be expected); head not ciliate, scales present or absent on gill cover---------------------**Dinematichthys** Bleeker
  4*a*. Maxillary wholly concealed by dermal fold of cheek when mouth is closed; scales imbricate; one short, blunt pyloric caecum on each side of pylorus------------------**Brosmophyciops**, new genus

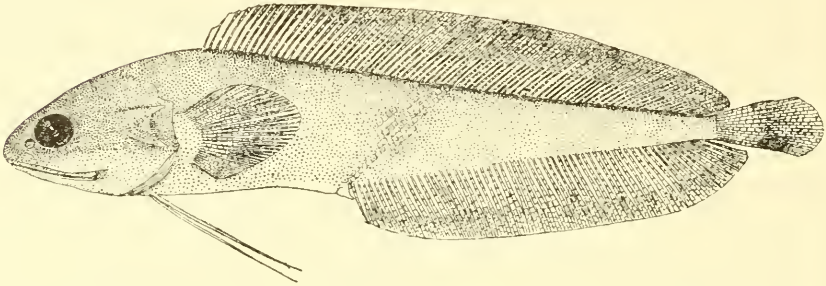

FIGURE 128.—*Brosmophyciops pautzkei*, new species, holotype, USNM 142023, from Bikini Atoll. Drawn by A. M. Awl.

BROSMOPHYCIOPS PAUTZKEI, new species

FIGURE 128

Holotype.—USNM 142023, Bikini Atoll, Arji Island, lagoon, depth 20 to 40 feet, August 7, S–46–308, Herald and Brock, standard length 53.8 mm.

Paratypes.—USNM 142024, A specimen taken with holotype and bearing same data, standard length 54 mm.; USNM 142026, Rongelap Atoll, Rongelap Island, lagoon, depth 18 feet, July 25, S–46–286, Brock, Herald and Kohler, 1 specimen, 55 mm.; USNM 142025, Bikini Atoll, Amen Island, lagoon, depth 30 feet, July 31, 1947, Donaldson and Welander, 1 specimen, 60.5 mm.

Description.—In order to make accurate counts it was necessary to dissect the skin from one side of the fins. The following counts are listed in the same order as the specimens recorded above: Dorsal rays 78; 79; 81 and 80; anal 58; 59; 60; and—; pectoral 26; 25; 27; and 29; pelvic rays upon close study seem to be represented by ii rays on each side (on superficial examination these appear to be a single ray); the branched caudal fin rays seem to vary, 5 or 6+5 or 6; and the gill rakers are represented by about 3 platelets on upper part of arch +1 developed raker at angle +2 developed rakers next to angle on lower arch, followed by about 8 platelets; the scales, difficult to count accurately, appear to number about 100 to 106 vertical rows from head to caudal fin base and about 23 from anal origin to base of dorsal fin.

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[21] *Brosmophycis* Gill, Proc. Acad. Nat. Sci. Philadelphia, vol. 13, p. 168, 1861 (type species, *Brosmius marginatus* Ayres).
Halias Ayers, Proc. California Acad. Nat. Sci., vol. 2, p. 52, 1861 (type species, *Brosmius marginatus* Ayres).

Precision measurements were made on the holotype and paratypes and these data, expressed in thousandths of the standard length, are recorded, respectively: Standard lengths 53.8, 54, 55, 60.5; length of head 257, 255, 251, and 254; greatest depth 197, 207, 200, and 199; least depth 28, 30, 27, and 25; snout 61, 61, 56, and 58; eye 57, 56, 55, and 53; tip of snout to rear edge of maxillary 145, 141, 131, 131; postorbital length of head 162, 168, 156, and 159; fleshy interorbital space 50, 54, 47, 50; snout tip to dorsal origin 316, 311, 315, and 305; length of pelvic fin 221, 206, 211, and 257; length of base of dorsal 728, 713, 705, and 685; length of anal base 515, 502, 488, and 486; length of pectoral fin 177, 165, 173, and 166; length of caudal fin 139, 144, —, and 133; longest dorsal fin ray 123, 126, 109, and 116; longest anal fin ray 123, 126, 109, and 116.

Head rounded, body compressed posteriorly; a vertical line through dorsal origin passes less than an eye diameter behind base of pectoral; anal origin a little closer to tip of snout than base of caudal fin; dorsal and anal composed of soft rays only, the longest rays posteriorly; caudal fin separate, not connected with dorsal or anal fins, middle rays longest; pectoral fins rounded; least depth of body a little less than twice in fleshy interorbital space; scales, thin, cycloid, imbricate on body, but absent on head; scales on base of pectoral, but absent on all other fins; maxillary concealed by a fleshy fold of the cheek, only upper lip of premaxillary exposed when mouth is closed; eye moderately large for a Brosmophycine fish, without free margin; anterior and posterior nostrils widely separated, the anterior one at front of side of snout with raised rim, posterior opening larger, just in front of eye, without distinct raised rim; tip of snout with fleshy fold bearing the usual pores and dermal lapetts, separate from upper lip; tip of chin with the usual 2 pairs of pores; a villiform band of teeth on premaxillary and palatines, on vomer the band is broadly ∧-shaped; teeth of lower jaw short, conical, in a single row posteriorly, anteriorly these are bordered externally by a narrow band of villiform teeth; all specimens are females and those opened had enlarged eggs; on each side of pylorus is a short, bluntly rounded pyloric caecum; lateral line obsolete; maxillary reaches a short distance behind a vertical line through rear of eye; interorbital space convex; lower jaw included; pelvic fins inserted on isthmus notably in front of pectoral base, not quite reaching to anus; gill membranes extending forward, free from isthmus.

Color in alcohol.—Plain brownish; fins whitish; dorsal surface of head dark brown; the paratypes are covered with a granular mucus that adheres to the scales so that if an attempt is made to remove the mucus, the scales come off too.

Ecology.—This new species, represented by four females, came from depths ranging from 18 to 40 feet. All the specimens were driven out of hiding in the vicinity of coral heads by the use of rotenone.

Remarks.—*B. pautzkei* differs from all other species referable to the subfamily *Brosmophycinae* in having the maxillary concealed by a fold of skin along lower edge of cheek.

Named *pautzkei* in honor of my former student, Clarence F. Pautzke, chief biologist in the Game Department of the State of Washington, who was at Bikini in 1946 and 1947.

Genus DINEMATICHTHYS Bleeker

Dinematichthys Bleeker, Nat. Tijdschr. Nederl. Ind., vol. 8, pp. 306, 319, 1855 (type species, *D. iluocoetcoides* Bleeker).

Ogilbia Jordan and Evermann, *in* Evermann and Kendall, Bull. U.S. Fish, Comm., vol. 17, p. 132, 1897 (type species, *O. cayorum* Evermann and Kendall).

Diancistrus Ogilby, Proc. Linn. Soc. New South Wales, vol. 23, p. 743, 1898 (type species, *D. longifilis* Ogilby).

Calcarbrotula Fowler, Proc. Acad. Nat. Sci. Philadelphia, vol. 98, p. 193, figs. 57, 58, 1946 (type species, *Calcarbrotula erythraea* Fowler, from Riu Kiu Islands).

Brotulina Fowler, Proc. Acad. Nat. Sci. Philadelphia, vol. 98, p. 195, figs. 59, 60, 1946 (type species, *Brotulina fusca* Fowler, from Riu Kiu Islands).

Dermatopsoides Smith, J. L. B., The sea fishes of southern Africa, p. 361, pl. 82, fig. 1011, 1949 (type species, *Dermatopsis kasougae* Smith).

Dr. Boyd Walker, University of California at Los Angeles, is revising this genus, but his manuscript was not ready for inclusion in this report when it went to press.

More than one species is involved in the material reported upon here. In addition to the type species cited above, the following species are referred to this genus: *Brosmophycis verrillii* Garman; *B. ventralis* Gill; *Dinematichthys mizolepis* Günther; and probably *Dinematichthys piger* Alcock.

DINEMATICHTHYS ILUOCOETEOIDES Bleeker

PLATE 111,A

Dinematichthys iluocoeteoides, BLEEKER, Nat. Tijdschr. Nederl. Ind., vol. 8, p. 319, 1855 (type locality, Batu Archipelago).

Brotulina fusca FOWLER, Proc. Acad. Nat. Sci. Philadelphia, vol. 98, p. 195, figs. 59, 60, 1946 (type locality, Riu Kiu Islands; holotype, ANSP 72070, a male examined by me).

Calcarbrotula erythraea FOWLER, Proc. Acad. Nat. Sci. Philadelphia, p. 193, figs. 57, 58, 1946 (type locality, Riu Kiu Islands; holotype, ANSP 72069, female, examined by me).

SPECIMENS STUDIED

Bikini Atoll: 23 stations, 353 specimens, 14 to 112 mm. in standard length.
Eniwetok Atoll: 4 stations, 16 specimens, 31 to 62 mm.
Rongerik Atoll: 4 stations, 23 specimens, 26 to 88 mm.
Rongelap Atoll: 9 stations, 34 specimens, 25 to 90 mm.
Kwajalein Atoll: 1 specimen, 46 mm.
Guam: 1 lot, 1 specimen, 51 mm.

Description.—Dorsal rays 75 to 88 and anal rays 59 to 69; pectoral 21 to 26; vertical scale rows from upper edge of gill opening to base of caudal fin 107 to 109 (based on 4 counts each); pelvic rays ii; branched caudal rays 7+7; gill rakers about 2+1+7 to 12. Greatest depth 3.9 to 4.3; head 3.6 to 3.8; length of pectoral fin 5.8 to 7.0; length of pelvic fin 3.5 to 4.0; length of caudal fin 6.8 to 9.2; all in standard length. Eye 9 to 11; snout 4.7 to 5.2; pectoral fin 1.8 to 2.0; caudal fin 2.0 to 2.3; greatest depth 1.2 to 1.3; interorbital space 4.0 to 4.5; length of mouth (snout tip to rear of maxillary) 1.9 to 2.1; all in length of head.

Head roundish, body posteriorly compressed, vertical line through dorsal origin passes about 1½ or 2 eye diameters behind head, anal origin about 2 eye diameters closer to snout tip than base of caudal fin; dorsal and anal fins of soft rays only extending to base of caudal fin; least depth of base of caudal fin or caudal peduncle about twice in interorbital space; pectoral and caudal fins rounded; scales cycloid, thin, extending on basal part of all fins except pelvics; pelvic fins of two simple hairlike rays inserted before pectoral bases; maxillary sheathed anteriorly by fleshy cheek, posteriorly exposed; eye small, without free margin; tip of chin and of lower lip finely papillate; tip of snout and of upper lip papillate; front part of upper lip slipping under front margin of snout; small conical teeth in bands on premaxillary, vomer, and palatines; dentary with small conical teeth in narrow band forward, becoming uniserial laterally; males with a spiny copulatory organ. The male copulatory organ of this species was described in detail by C. L. Turner (Copeia, No. 2, pp. 92–96, pl. 1, 1946).

Color in alcohol.—Plain tan to light brown or whitish. Peritoneum white.

Color when alive.—Plain orange.

Ecology.—This brotulid lives in the crevices of the reefs and is most abundant along submerged ledges.

Remarks.—I examined the holotypes of Fowler's two species from the Ryukyu Islands and found them to be a male and a female of this abundant species. *Dermatopsis kasougae* Smith may be this species, too.

Family CARAPIDAE: Pearlfishes

By Leonard P. Schultz

The recognition of more than one valid genus for the family Carapidae has been questioned by Parr (Bull. Bingham Oceanogr. Coll., vol. 3, art. 4, pp. 133–136, 1930) and from time to time by other authors. The extensive material before me (61 jars containing one or more specimens) has made it possible to give some needed attention to the genera of this family. Without doubt six distinct genera should be recognized. They are diagnosed in the following key:

KEY TO THE GENERA OF CARAPIDAE

1*a*. Premaxillary protractile; anus behind pectoral fin base opposite a point one fourth to one half the length of pectoral fin out from its base; pectoral fin notably longer than postorbital length of head; a pair of fanglike canines at front of both upper and lower jaws; first three gill rakers next to angle on lower limb of first gill arch elongate, the remainder short; maxillary freely movable posteriorly; peritonuem black; greatest depth of body 1.2 to 1.3 in length of head of adults; dorsal origin in front of a vertical line through anus, about 1.0 to 1.3 head lengths behind tip of snout.

  2*a*. No pelvic rudiments............................ **Snyderidia**[22] Gilbert

  2*b*. Pelvic rudiments present............ **Pyramodon**[23] Smith and Radcliffe

1*b*. Premaxillary not protractile, at least bound to the snout with a frenum; anus in front of a vertical line through middle of base of pectoral fin; pectoral fin, if present, notably shorter than postorbital length of head; no long fanglike canines at front of jaws; greatest depth of body about 1½ to 2 times in head length of adults.

  3*a*. Maxillary not free and movable, bound firmly by tissue to head; no caninelike teeth on jaws, minute teeth on jaws and palatines; a few short conical teeth on vomer; none of the gill rakers on first arch notably longer than others, all very short; posteriorly the median fins blackish; peritoneum with scattered blackish pigmented areas.

    4*a*. Pectoral fins well developed, about twice in postorbital length of head. **Jordanicus** Gilbert

    4*b*. Pectoral fins absent.......................... **Encheliophis** Müller

  3*b*. Maxillary posteriorly free and movable; with or without caninelike teeth in jaws; usually somewhat enlarged conical teeth on vomer; first three gill rakers next to angle of lower limb of first gill arch notably elongate, the others short; pectoral fin well developed, its length once or twice in postorbital length of head.

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[22] *Snyderidia* Gilbert, Bull. U. S. Fish. Comm., vol. 23 (1903), pt. 2, p. 654, pl. 92, 1905 (type species, *Snyderidia canina* Gilbert; Hawaiian Islands).

[23] *Pyramodon* Smith and Radcliffe, *in* Radcliffe Proc. U. S. Nat. Mus., vol. 44, p. 175, pl. 17, fig. 3, 1913 (type species, *Pyramodon ventralis* Smith and Radcliffe; Dutch East Indies, near Doworra Island).

The inclusion of *Snyderidia* and *Pyramodon* in the family Carapidae indicates the close relationship among the families allied to the pearlfishes such as Brotulidae and Lycodapidae and possibly some of the Zoarcidae. The numerous genera in these families are so variable and confusing in relationships that a clear separation has not as yet been made.

5*a*. Greatest depth of body 1⅓ to 1⅘ times in length of head; vertebrae more than 100 ---------------------------- **Carapus** Rafinesque

5*b*. Greatest depth of body equal to head length; vetebrae 90 or fewer. **Onuxodon** [24] Smith

Genus JORDANICUS Gilbert

Jordanicus GILBERT, Bull, U. S. Fish. Comm., vol. 23 (1903), pt. 2, p. 659, 1905 (type species, *Fierasfer umbratilis* Jordan and Evermann).

JORDANICUS GRACILIS (Bleeker)

PLATE 120,F

Oxybeles gracilis BLEEKER, Nat. Tijdschr. Nederl.-Indië, vol. 11, p. 105, 1856 (type locality, Banda).

Fierasfer umbratilis JORDAN and EVERMANN, Bull. U. S. Fish Comm., 1902, vol. 22, p. 206, 1903 (type locality, Hawaiian Island).

SPECIMENS STUDIED

Bikini Atoll; Enyu Island, March 13, S–46–6, Brock, 1 specimen, 154 mm. total length.

In addition I have studied 4 other specimens; USNM 65884, Tahiti; USNM 115402, Tau Island, Samoan group; USNM 122812, Philippines; and the holotype, USNM 50656, of *F. umbratilis*, Hawaiian Islands.

Description.—Body elongate, tapering to a point posteriorly; head about 9 times in total length and greatest depth about 18 times; anus slightly in front of a vertical line through pectoral fin base; anal origin just behind anus; dorsal fin beginning so gradually that the exact point of origin is not clear, but at about two headlengths behind snout tip; median fins probably not fully continuous around tip of tail; lateral line present and running a course along the midlengthwise axis of body; gill membranes joined together far forward, and free from the isthmus; gill opening restricted to below upper edge of pectoral fin base; 3 free gill arches, the opening behind the fourth arch small; postorbital length of head 1.6 in head; greatest depth of body twice in head length; pectoral fin present, 3.2 in head and 1.9 in postorbital length of head; eye 2½ in postorbital length of head; maxillary reaching past orbit, from tip of snout to rear edge of embedded maxillary 2½ in head and 1½ in postorbital length of head; teeth in both jaws and on palatines minute, in one or two rows; two or three slightly enlarged conical teeth on vomer; none of the gill rakers notably more elongate than others, all very short; no pungent spine on opercle.

Color in alcohol.—Background color pale, with numerous brownish pigment cells more or less arranged in narrow vertical bars anteriorly; posteriorly the dorsal and anal fins are black, this color not extending forward beyond one fourth of the total length. Peritoneum dusky.

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[24] *Onuxodon* Smith, Ann. Mag. Nat. Hist., ser. 12, vol. 8, pp. 403, 404, 1955 (type species, *Carapus parvibrachium* Fowler).

Ecology.—The specimen from Bikini came from a sea cucumber, 2 feet long, with warty brown skin, taken at a depth of about 15 to 20 feet, identified by the late Austin Clark of the Smithsonian Institution as *Holothuria atra* Jäger.

Genus ENCHELIOPHIS Müller

Encheliophis Müller, Abh. Akad. Wiss. Berlin, p. 153, 1843 (type species, *Encheliophis vermicularis* Müller).

Encheliophiops Reid, Allan Hancock Pacific Exped., Univ. Southern California, vol. 9, No. 2, p. 47, 1940 (type species, *Encheliophiops hancocki* Reid; Gorgona Island, Colombia, S. A., in Pacific).

A comparison of Reid's holotype of *E. hancocki* with the two specimens from Guam described below does not indicate that two genera should be recognized. Probably there are two species, at least the two should stand until more specimens have been collected and studied. The genus *Encheliophiops* was based on a small specimen that still retained some of the youthful features of other carapids such as more slender body and the dorsal and anal fins not being fully continuous around the tail. Other generic characters are listed in the key.

ENCHELIOPHIS VERMICULARIS Müller

Plate 120,G

Encheliophis vermicularis Müller, Abh. Akad. Wiss. Berlin, p. 154, pl. 5, fig. 4, 1843 (type locality, Philippines).

SPECIMENS STUDIED

Guam: Tumon Bay, June 20, 1945, L. Gressitt, 2 specimens, USNM 124249, 95 and 125 mm. total length.

Description.—Body elongate, eel-shaped, tapering to a point posteriorly; head about 11 or 12 times and greatest depth of body 20 to 24 times in total length; anus a trifle behind the rear edge of head; anal fin origin a short distance behind anus; dorsal fin beginning so gradually that its origin is not clear, probably begins 3 or 4 head lengths behind tip of snout; median fins probably not fully continuous around tip of tail; lateral line pores indistinct but apparently along middle of sides; gill membranes joined far forward but free from isthmus; gill opening not extending above middle of side; first 3 gill arches with slits behind, fourth arch imbedded; postorbital length of head 1.4 to 1.5 in head; greatest depth of body 1.8 to 2.1 in head; no pectoral fin; eye 4½ to 6 in postorbital length of head; maxillary not free, reaching past orbit, distance from rear edge of maxillary to tip of snout about 2½ in head and 1⅔ to 1⅘ in postorbital length of head; teeth in upper jaw very small, conical, one row posteriorly, 2 rows anteriorly; a single row of small conical teeth on lower jaw; palatines with 2 rows of small conical teeth, vomerine teeth slightly larger than other teeth but no caninelike teeth anywhere; none of the gill rakers more elongate than others, all very short.

Color in alcohol.—Background color plain pale with pigment spots becoming more numerous posteriorly, the last third of body brownish and last fourth blackish or dark brownish.

Ecology.—Both specimens came from the long, brown-skinned sea cucumber *Holothuria atra.*

Genus CARAPUS Rafinesque

Carapus RAFINESQUE, Indice d'ittiologia Siciliana . . . , pp. 37, 57, 1810 (type species, *Gymnotus acus* Linnaeus).

KEY TO SPECIES OF CARAPUS FROM MARSHALL AND MARIANAS ISLANDS

1*a*. Dorsal parts of head and body anteriorly and sides posteriorly profusely speckled with brown pigment spots; diameter of eye 3.0 to 4.0 and length of pectoral fin 1.4 to 1.8 in postorbital length of head. **C. mourlani** (Petit)

1*b*. No pigment spots externally; diameter of eye 2.2 to 2.6 and length of pectoral fin 1.2 to 1.4 in postorbital length of head____**C. homei** (Richardson)

CARAPUS MOURLANI (Petit)

PLATE 120,E

Fierasfer mourlani PETIT, Bull. Mus. Nat. Hist. Nat. Paris, ser. 2., vol. 6, p. 393, fig. 1934 (type locality, southwest coast of Madagascar).

SPECIMENS STUDIED

Bikini Atoll: 2 stations, 2 specimens, 88 to 110 mm. in standard length.
Rongerik Atoll: 1 station, 2 specimens, 91.5 to 93 mm.
Saipan: 1 lot, 9 specimens, 68 to 90 mm.

Description.—Body elongate, tapering to a point posteriorly; head about 6 to 8 and greatest depth about 10 to 13 in total length; anus a little in front of pectoral fin base; anal origin just behind anus; dorsal fin origin distinct, 1.7 and 1.9 head lengths behind tip of snout; median fins continuous around tip of tail; lateral line canal running along middle of the sides; gill membranes joined far forward but free from isthmus; gill opening reaching to a little over ½ eye diameter above upper edge of pectoral fin base; an opening behind the fourth gill arch; postorbital length of head 1.6 to 1.7 in head; greatest depth of body 1.5 to 1.7 in head and 1.0 to 1.1 in postorbital length of head; eye 3.0 to 3.5 in postorbital length of head; maxillary free posteriorly, reaching past a vertical line through rear of orbit; tip of snout to rear of maxillary 1.9 to 2.1 in head and 1.2 to 1.3 in postorbital length of head; small conical teeth in a narrow band on upper jaw, inner series largest, one or two pairs of short canines near symphysis; lower jaw with band of conical teeth larger than in upper, the outer row with a few caninelike teeth; similar conical teeth in a band on palatines with a few a little larger than others; vomer with 2 to 4 enlarged canine teeth hooked posteriorly; first three gill rakers on lower limb of first gill arch notably elongate, others short; pectoral fin present, 2.5 to 2.7 in head and 1.5 to 1.8 in postorbital length of head; a strong pungent opercular spine embedded in flesh of operculum.

In addition to the 3 Marshall Island specimens described above, Brock sent the U. S. National Museum 4 specimens from Koko Head, Oahu Island, taken from *Culcita novaguineae*, ranging in total length from 70 to 118 mm. These specimens appear to be more robust, as indicated by the proportions for the three largest, ranging from 86.8 to 118 mm. in total length: Head 6.5 to 6.8, depth 9.7 to 10.3, both in total length; eye 5.6 to 6.2 pectoral fin 2.1 to 2.6, depth 1.5 to 1.6 all in length of head; eye 3.3 to 4.0, pectoral 1.3 to 1.7, greatest depth 0.67 to 0.96, all in postorbital length of head.

Color in alcohol.—Background color pale, with dorsal surfaces of head and body with brownish pigment spots, these also occurring on sides posteriorly and on cheeks and underside of lower jaw. Peritoneum silvery with numerous, crowded tiny black pigment spots.

Color when alive.—Color notes recorded for a specimen from station S–46–476, placed in a glass jar: Generally transparent, circulatory system red; tail with red spots; sides of abdomen irridescent; small blackish pigment spots on back, cheeks, under eye, on snout and chin, and posteriorly on sides; dorsal surface of eye pinkish. Peritoneum black.

Ecology.—The pearlfishes listed above (from stations S–46–403; 476; and 1041) were removed from the body cavity of the armless starfish, *Culcita novaguineae*. Among those starfishes brought to the surface by Brock, fewer than half had a pearlfish in their body cavity. These specimens of *Culcita* measured about 8 inches in diameter.

Remarks.—The identification of our material as *C. mourlani* Petit was done with considerable uncertainty. It is clear, however, that the Marshall Islands specimens are distinct from those herein recorded as *homei*. We believe that, as more is learned about each species of *Carapus*, it is probable they will be found to inhabit a certain genus of invertebrate animal. Much of the difficulty encountered in identifying species of *Carapus* lies in the abbreviated descriptions and lack of knowledge of the hosts from which the specimens were taken. Thus, no fewer than 24 names are available for species probably referable to the genus *Carapus* in the Pacific and Indian Oceans.

We note that only *Oxybeles lumbricoides* Bleeker (Nat. Tijdschr. Nederl.-Indië, vol. 7, pp. 162–163, 1854; Ceram, probably from *Culcita*) has been taken from the armless starfish *Culcita*. Bleeker's description is too abbreviated to permit identification of *lumbricoides*.

Very special attention must be given to the collection of series of *Carapus* from the various hosts in order to furnish sufficient information on habits and characters for the proper separation of species.

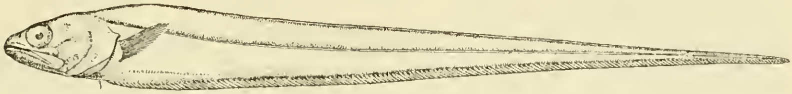

Figure 129.—*Carapus homei* (Richardson), USNM 122661, from the *Albatross* Philippine Collection.

CARAPUS HOMEI (Richardson)

Figure 129

Oxybeles homei Richardson, Ichthyology, *in* Richardson and Gray, Zoology of the voyage of H. M. S. *Erebus* and *Terror* . . . , p. 74, pl. 44 figs. 7–18, 1846 (type locality, "Seas of Australia? and Timor").

Oxybeles brandesii Bleeker, Nat. Tijdschr. Nederl.-Indië, vol. 1, p. 276–278 figs. 1–3, 1851 (type locality, Banda).

SPECIMENS STUDIED

Eniwetok Atoll: 1 lot, Univ. Washington, 1 specimen, 89 mm. in total length.
Guam: 3 lots, 4 specimens, 86 to 128 mm.
Philippines: 1 lot, 1 specimen, 165 mm.

Description.—Body elongate, tapering to a point posteriorly, head about 6 to 8 and greatest depth about 10 to 14 in total length; anus a little in front of a vertical line through front of pectoral fin base; anal origin just behind anus; dorsal fin origin distinct, about 1.7 and 1.9 head lengths behind tip of snout; median fins continuous around tip of tail; lateral line canal along middle of sides; gill membranes joined far forward, but free from isthmus; gill opening reaching to about one-fourth eye diameter above pectoral fin base; an opening behind the fourth gill arch; postorbital length of head 1.5 to 1.7 in length of head; greatest depth of body 1.5 to 1.8 in head, 0.86 to 1.1 in postorbital length of head; eye 2.2 to 2.6 in postorbital length of head; maxillary free posteriorly, reaching past a vertical line through rear of orbit; tip of snout to rear of maxillary 1.9 to 2.0 in head length and about 1.2 in postorbital length of head; small conical teeth in a narrow band in upper jaw with those of inner row a little enlarged and one or two pairs of short caninelike teeth at symphysis; lower jaw with larger conical teeth than upper, in a band, the outer row forward, with enlarged caninelike teeth much larger than those in upper jaw; palatines with a band of conical teeth; vomer with 2 to 4 enlarged canine teeth directed posteriorly; first 3 gill rakers on lower limb next to angle elongate, the others short; pectoral fin 2.0 to 2.0 in head and 1.2 to 2.4 in postorbital length of head; pungent opercular spine embedded in the flesh of operculum.

Color in alcohol.—Coloration plain pale, no pigment cells evident externally on head or body. Peritoneum silvery with numerous crowded blackish pigment cells.

Ecology.—The specimens were taken from holothurians.

Remarks.—Among the differences observed between the specimens of *C. homei* and *C. mourlani*, the most outstanding is the complete lack of external pigment in the former, whereas the latter is marked with numerous large pigment cells. Other differences (those for *homei* given first) are: Pectoral fin 2.0 to 2.2 instead of 2.5 to 2.7 in head, and 1.2 to 1.4 instead of 1.5 to 1.8 in postorbital length of head; eye in postorbital length of head 2.2 to 2.6 instead of 3.0 to 3.5. These data were from specimens of comparable lengths. In addition *homei* appears to live in holothurians and *mourlani* in the armless starfish *Culcita*.

Bleeker's original description did not give the host for *brandesei* but later, when *lumbricoides* was named *brandesii*, this pearlfish was mentioned by Bleeker as occurring in *Culcita*. However, his original figure of *brandesii* shows the large eye of *homei* and I follow previous authors in referring it to the synonymy of *homei*. The present state of knowledge is too much confused in regard to the identifications of the species of *Carapus* to permit any conclusion on the validity of the numerous species already named in the Indo-Pacific.

The illustration for this species is of the Philippine specimen listed.

Suborder SCHINDLERIINA

Family SCHINDLERIIDAE

By Leonard P. Schultz

Genus SCHINDLERIA Giltay

Schindleria Giltay, Bull. Mus. Hist. Nat. Belgique, vol. 10, No. 13, p. 8, 1934 (type species, *Hemirhamphus praematurus* Schindler).

SCHINDLERIA PRAEMATURUS (Schindler)

Plate 121,A

Hemirhamphus praematurus Schindler, Anz. Akad. Wiss. Wien, No. 9, p. 79, 1930 (type locality, Pear and Hermes Reef, Hawaiian Islands).

SPECIMEN STUDIED

Bikini Atoll: Bikini lagoon, light at night, S–46–112, April 24, 1946, 1 specimen, ♀, 15.5 mm. in standard length.

Description.—With difficulty it has been determined that this specimen has 19 dorsal, 11 anal and 16 pectoral rays.

Color in alcohol.—Light brownish.

Color when alive.—Transparent.

Remarks.—This strange family of pelagic fishes is known from the tropical Pacific through the following publications:

Schindler (Anz. Akad. Wiss. Wien, No. 9, p. 79, 1930, *Ibid*, No. 1, p. 2, 1931; Bernice P. Bishop Mus. Bull. 97, pp. 1–28, pls. 1–9, 1932; Sitzb. Akad. Wiss. Wien, vol. 143, p. 265, 1934); Giltay (Bull. Mus. Hist. Nat. Belgique, vol. 10, No. 13, pp. 1–10, figs. 1–4, 1934); and Bruun (Dana Report, vol. 4, No. 21, pp. 1–12, figs. 1–8, 1940).

S. pietschmanni (Schindler) is known only from the Hawaiian Islands, whereas *S. praematurus* has been found in the Hawaiian Islands; Manokwari, New Guinea; Papeete Harbor, Tahiti; Apia Harbor, Samoa; Tasman Sea, off Sydney, and Grafton, Australia; and my specimen from Bikini lagoon. Undoubtedly this pelagic species will be found widely distributed in the tropical Pacific. Most of the material so far collected has been taken with a dip net at night, as *Schindleria* was attracted to a light.

Suborder CALLIONYMINA

Family CALLIONYMIDAE

By LEONARD P. SCHULTZ

Schultz and Woods (Journ. Washington Acad. Sci., vol. 38, No. 12, p. 419, 1948) defined relationships within this family in their key to the genera of Callionymidae. Unfortunately, the usefulness of their key was impaired when, through a printer's error, couplet 5*b*, which should have followed 7*b*, was transposed to follow 5*a*. Also, in couplet 2*b* and footnote 9 the generic name *Dactylopus* is misspelled.

Since that time de Beaufort has published a valuable account (Fishes of the Indo-Australian Archipelago, vol. 9, pp. 50–81, 1951), giving a key to the genera which differs considerably from the one published by Schultz and Woods.

The species referred to this family, numerous and too frequently not adequately described, are in need of revision. Much of the confusion results from the sexual dimorphism and sexual dichromatism so characteristic of the members of this family. Adult males may have greatly elongated fin rays when compared with the females; thus, females and males are described as distinct species.

Ochiai, Aroga, and Nakajima (Publ. Seto Mar. Biol. Lab., vol. 5, No. 1, pp. 96–132, figs. 1–18, 1955) revised the species from Japan referable to *Callionymus*. They recognize 16 species.

KEY TO THE GENERA OF CALLIONYMIDAE

1*a*. Two dorsal fins.

2*a*. No pelvic ray free or separate from others, all connected by membrane.

3*a*. Two lateral lines, the lower one represented by a fleshy keel or membranous fold along the lower side of the body beginning opposite anterior base of anal fin; opercular membrane ending in a free flap; posterior part of maxillary semitubular in form with a very short anterior and outwardly projecting concave lobe, scarcely noticeable in small specimens; opercular opening superior in position, above opercle, in form of a small foramen; pelvic fins connected to pectoral base by a membrane attached opposite about fourth to sixth pectoral ray from dorsal edge; upper lateral line simple; no orbital tentacle; preopercular spine acute, with small spines dorsally, and a small antrorse spine basally; soft dorsal and anal rays all unbranched, except last one in each fin is branched to base------------------------------------**Diplogrammus** Gill

3*b*. A single lateral line located mostly in dorsal half of body, no thin fold of skin along lower side.

4*a*. An orbital tentacle in combination with a broad fleshy lower lip folded under chin; opercular opening a small foramen above opercle; no free opercular flap; membrane of pelvic fin attached as far dorsally as a little below middle of base of pectoral fin; lateral line simple; preopercular spine acute, with serrae dorsally or ventrally and with an antrorse spine basally; all rays of soft dorsal and anal fins unbranched, except last one in both fins branched to base--------------------------**Amora** [25] (Gray)

4*b*. No orbital tentacle, or if a minute one occurs, lower lip not broad and folded below tip of chin.

5*a*. Pelvic fin membrane absent, no dermal membrane connecting with the pectoral fin base; preopercular spine without basal antrorse spine.

6*a*. Opercle ending in a free dermal flap; gill opening in a superior position at rear of opercle; lateral line without elongate side branchings; body very robust; all rays of soft dorsal and of anal unbranched, except last one is branched to base.
Eleutherochir [26] Bleeker

6*b*. No free opercular flap of skin; gill opening superior in position above opercle; rays of anal unbranched, except last one is branched to base.

7*a*. Lateral line with short branches at right angles; all rays of soft dorsal unbranched, except last is branched to base.
Paracallionymus [27] Barnard

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[25] *Amora* Gray, Illustrations of Indian zoology, . . . Hardwicke, vol. 2, pl. 90, fig. 1, 1833–34 (type species, *Amora tentaculata* Gray=*Anaora* Gray, ibid., probably typographical error for *Amora* in directions for arranging plates).

Synchiropus tentaculatus Herre (Philippine Journ. Sci., vol. 35, p. 33, pl. 3, 1928) is a synonym of *A. tentaculata* Gray; it is also a homonym but no substitute name is needed since it is a synonym. *Callionymus fimbriatus* Herre, Notes on fishes in the Zoological Museum of Stanford University. 1. The fishes of the Herre Philippine Expedition of 1931, p. 94, 1934, is a synonym of *A. tentaculata* Gray.

[26] *Eleutherochir* Bleeker, Versl. Akad. Wet. Amsterdam, ser. 2, vol. 14, p. 103, 1879 (type species, *C. opercularioides* Bleeker).

Brachycallionymus Herre and Myers, *in* Herre, Proc. Biol. Soc. Washington vol. 49, p. 12, 1936 (type species, *B. mirus* Herre = *C. opercularioides* Bleeker).

[27] *Paracallionymus* Barnard, Ann. Mag. Nat. Hist., ser. 9, vol. 20, p. 69, 1927 and Ann. South African Mus., vol. 21, p. 448, 1927 (type species, *C. costatus* Boulenger).

7*b*. Lateral line simple, unbranched, soft rays of dorsal branched and last one to its base---------- **Yerutius**[28] Whitley

5*b*. Pelvic membrane present and connected with base of pectoral fin near its middle; no free opercular flap; gill opening a small foramen, superior in position above opercle; lateral line simple; orbital tentacle absent.

8*a*. Preopercular spine with a basal antrorse spine or one near its ventral edge; all rays of dorsal and of anal fins unbranched except last one in both fins branched to base.
Callionymus Linnaeus

8*b*. No antrorse spine at base or on ventral side of preopercular spine; first soft dorsal ray usually unbranched, all the rest branched (except in young), the last one to its base; anal rays unbranched, except last one or two, the last to its base.
Synchiropus Gill

2*a*. The first ray of pelvic not connected by a membrane with the next ray; gill opening behind opercle-------------------- **Dactylopus**[29] Gill

1*b*. A single dorsal fin, the spiny part lacking; gill opening superior in position at rear of opercle; pelvic membrane not connected with pectoral base; lateral line simple; orbital tentacle lacking; no antrorse spine near basal part of preopercular spine; soft dorsal rays branched at tips, last one to its base; all anal rays unbranched, except last is branched to base; lower lip fringed-------------------------------- **Draculo**[30] Snyder

Genus DIPLOGRAMMUS Gill

Diplogrammus GILL, Ann. Lyceum Nat. Hist. New York, vol. 8, p. 143, 1865 (type species, *Callionymus goramensis* Bleeker).

Calymmichthys JORDAN and THOMPSON, Mem. Carnegie Mus., vol. 6, No. 4, p. 296, pl. 36, fig. 2, 1914 (type species, *Calymmichthys xenicus* Jordan and Thompson).

Diacallionymus FOWLER, Proc. U. S. National Museum, vol. 90, p. 29, 1941 (type species, *Callionymus goramensis* Bleeker).

Dermosteira SCHULTZ, U. S. Nat. Mus. Bull. 180, p. 267, fig. 26, 1943 (type species, *Dermosteira dorotheae* Schultz).

The figure of *Calymmichthys xenicus* by Jordan and Thompson, does not show the (pp. 296–7) "thin but prominent fold of skin extending from pectoral tips to base of caudal . . . along side of body." However, a study of the holotype, CM 6027, reveals that their statement is correct. This fold of skin places *C. xenicus* as a species close to *Callionymus goramensis*, *C. cooki* Günther, and *D. dorotheae* Schultz. Fowler (Proc. Acad. Nat. Sci. Philadelphia, vol. 93, p. 92, figs. 5, 6, 1941) described *C. floridae* from Florida, possibly the first record for this genus in the Atlantic.

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[28] *Yerutius* Whitley, Rec. Australian Mus., vol. 18, p. 115, 1931 (type species, *C. apricus* McCulloch).

[29] *Dactylopus* Gill, Proc. Acad. Nat. Sci. Philadelphia, 1859, p. 130, 1860 (type species *C. dactylopus* Bennett = *D. bennetti* Gill).

Vulsus Günther, Catalogue of the fishes in the British Museum, vol. 3, p. 151, 1861 (type species, *C. dactylopus* Bennett).

[30] *Draculo* Snyder, Proc. U. S. Nat. Mus., vol. 40, p. 545, 1911 (type species, *Draculo mirabilis* Snyder).

Study of the Marshall Islands material of this genus leads to the conclusion that the specimens listed from there belong to a single species. They vary greatly in color pattern, but intermediates are found that connect *C. xenicus*, a mature male, with less mature males of *D. dorotheae*, *C. cooki* Günther, and *C. cooki* as figured by Herre (Field Mus. Nat. Hist. Zool. Ser., vol. 21, pp. 391–2, fig. 35, 1936). These three named forms are believed to represent the same species, *Callionymus goramensis* Bleeker. In nearly all previous descriptions of this form of callionymid, few comparisons have been made with already described species, mostly because of the confused nature of the literature and the lack of a comprehensive revision. The exact relationship of these four species cannot be determined without large series from Japan, the Phoenix Islands, Cook Island, and Goram Island.

However, bringing them together here will at least call the attention of ichthyologists to this group of "species," not previously defined in relation to each other.

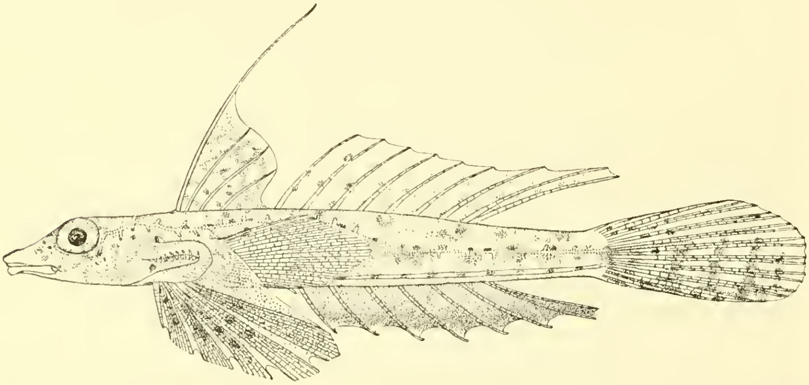


FIGURE 130.—*Diplogrammus goramensis* (Bleeker), USNM 115735, after Schultz.

DIPLOGRAMMUS GORAMENSIS (Bleeker)

FIGURE 130

Callionymus goramensis BLEEKER, Nat. Tijdschr. Nederl.-Indië, vol. 15, p. 214, 1858 (type locality, Goram Island).

Callionymus cooki GÜNTHER, Proc. Zool. Soc. London, 1871, p. 665 (type locality, Rarotonga, Cook Island).

Calymmichthys xenicus JORDAN and THOMPSON, Mem. Carnegie Mus., vol. 6, No. 4, p. 296, pl. 36, fig. 2, 1914 (type locality, Sagami Bay, Japan).

Dermosteira dorotheae SCHULTZ, U. S. Nat. Mus. Bull. 100, p. 267, fig. 26, 1943 (holotype USNM 115735; type locality, Rose Island, Manua Islands).

SPECIMENS STUDIED

Bikini Atoll: 9 stations, 14 specimens, 22 to 48 mm. in standard length.
Rongelap Atoll: 4 stations, 23 specimens, 20 to 52 mm.

Eniwetok Atoll: 2 stations, 16 specimens, 12 to 44 mm.
Rongerik Atoll: 17 specimens, 13 to 55 mm.

Description.—Dorsal rays IV–vi or vii,1; anal v or vi,1; pelvics I,5; pectorals ii,15 or 16; branched caudal 4+3. (See table 119.)

Head to tip of free opercular flap 3.1 to 3.3; head to rear tip of preopercular spine 2.9 to 3.2; greatest depth of body 7.1 to 7.4; longest ray of pectoral 4.5 to 4.8 and of pelvic 3.5 to 4.0; all in standard length. Snout 3.4 to 4.1; eye 4.4 to 4.7; postorbital length of head to tip of opercular flap 1.8 to 2.1 and to tip of preopercular spine 1.6 to 1.9; tip of snout to posterior edge of maxillary 3.2 to 4.0; longest pectoral ray 1.3 to 1.6; longest pelvic ray 1.1 to 1.4; all in length of head to tip of preopercular spine. Least width of interorbital space 5.0 to 5.5 in eye.

Head depressed, snout depressed and slightly concave, projecting slightly beyond tip of lower jaw; premaxillaries protractile, not quite reaching to tip of snout when fully retracted; teeth villiform, in a wide band at front of premaxillary, narrower laterally; teeth in lower jaw villiform and arranged similarly; no teeth on vomer or palatines; a free dermal flap at rear of opercle that usually does not quite reach to opposite tip of preopercular spine; preopercular spine rather elongate and straight, about 3½ times in length of head to tip of preopercular spine; a small antrorse spine near base of preopercular spine and 9 or 10 serrae along upper edge, including the dorsally curved spiny tip; gill opening above opercle in the form of a small foramen; the membrane connecting the pelvic fin with the pectoral base is joined to latter opposite bases of third to fifth rays from top; two lateral lines, the dorsal one with an arch over pectoral fin then behind it, extending near midlengthwise axis of body, the lower lateral line has a fleshy dermal keel along lower side of body, beginning about opposite base of second anal ray; body and head naked; maxillary at its posterior extremity semitubular, with an anteriorly projecting very short concave lobe; no orbital tentacle.

There is considerable sexual dimorphism: Males have the first spiny ray of dorsal greatly elongate or threadlike, usually not quite reaching to base of last dorsal ray, and an anal papilla is present on adults; the female specimen has the first dorsal spine scarcely longer than second, and no anal papilla.

Color in alcohol.—The color pattern is variable among the specimens at hand, and considerable sexual dichromatism is evident. Background color whitish or slightly tan, with several blackish pigmented spots or small areas irregularly arranged in rather indistinct bars. Males have the anal fin blackish, with rays white tipped; sexually mature males have several dark-edged pale bands or streaks on the sides of the head as shown in Jordan and Thompson's figure of *C. xenicus;*

also there is a pale-centered dark opercular blotch; fins barred with dark blotches similar to Schultz's figure of *D. dorotheae* and Herre's (1936) figure of *C. cooki*. There is but one adult female with mature eggs (from Rongerik Atoll) and it is more strikingly colored than any other specimens; the dark brown bars on back, one through base of spiny dorsal, second at origin of soft dorsal, third through bases of last two dorsal rays, and fourth on caudal peduncle, sharply contrast with the blotched yet whitish interspaces; rear two-thirds of spiny dorsal fin blackish, tip of first dorsal ray white; anal fin plain translucent, except for a dark spot on distal part of membrane between first and second anal rays, followed by a narrow dark streak, distally, the margin and tips of anal rays white; opercular blotch is in the form of a short narrow dark streak; side of body between lateral lines with 6 dark blotches; keel of lower lateral line with 6 or 7 dark spots.

Ecology.—This species occurred on the ocean and lagoon reefs, but was never taken in great abundance; specimens occurred down to a depth of 30 feet. It seemed to prefer areas where there was a sandy bottom around coral growths.

Genus CALLIONYMUS Linnaeus

Callionymus Linnaeus, Systema naturae, ed. 10, p. 249, 1758 (type species, *C. lyra* Linnaeus).

Calliurichthys Jordan and Fowler, Proc. U. S. Nat. Mus., vol. 25, p. 941, 1903 (type species, *Callionymus japonicus* Houttuyn).

Repomucenus Whitley, Australian zool., vol. 6, p. 323, 1931 (type species, *Callionymus calcaratus* Macleay).

Callimucenus Whitley, in McCulloch Suppl. Checklist fishes N. S. Wales, 3rd ed., No. 398, p. 418, 1934 (type species, *Callionymus macdonaldi* Ogilby).

Velesionymus Whitley *Ibid*, p. 418 (type species, *Callionymus limiceps* Ogilby).

In the genus *Calliurichthys* the tip of the preopercular spine is supposed to end in a straight point instead of being curved dorsally or sometimes hooked forward, but there is too much variation in this character for it to serve as the basis for a separate genus.

In attempting to identify our Northern Marshall Islands specimens referred to *Callionymus*, the descriptions and figures of the following Pacific species belonging in the genus have been studied, and if the holotype occurs in the National collections its number is listed: *C. caeruleonotatus* Gilbert 1905, USNM 51603; *C. corallinus* Gilbert 1905, USNM 51581; *C. decoratus* Gilbert 1905, USNM 51609; *C. umbrithorax* Fowler 1941, USNM 99433; *C. scabriceps* Fowler 1941, USNM 99406; *C. boleogenys* Fowler 1941, USNM 99408; *C. marisinensis* Fowler 1941, USNM 99410; *C. hudsoni* Fowler 1941, USNM 99412; *C. longi* Fowler 1941, USNM 99418; *C. brunneus* Fowler 1941, USNM 99419; *C. punctilateralis* Fowler 1941, USNM 99422; *C. keeleyi* Fowler 1941, USNM 99425; *C. distethommatus* Fowler 1941, USNM 99426; *C. leucobranchialis* Fowler 1941, USNM

99393; *C. flagris* Jordan and Fowler 1903, paratypes USNM 51384–5; *C. beniteguri* Jordan and Snyder 1901, USNM 49402; *C. japonicus* Houttuyn 1782 = *C. longicaudatus* Temminck and Schlegel 1845 = *C. reevesii* Richardson 1844 = *C. belcheri* Bleeker 1879 = ? *C. lineathorox* Fowler 1943; *C. doryssus* Jordan and Fowler 1903; *C. variegatus* Temminck and Schlegel 1845; *C. valenciennesi* Temminck and Schlegel 1845; *C. calliste* Jordan and Fowler 1903; *C. virgis* Jordan and Fowler 1903; *C. cooperi* Regan 1908; *C. maldivensis* Regan 1908; *C. affinis* Regan 1908; *C. gardineri* Regan 1908; *C. spiniceps* Regan 1908; *C. belcheri* Richardson 1844; *C. hindsii* Richardson 1844; *C. calcaratus* Macleay 1881; *C. limiceps* Ogilby 1908; *C. grossi* Ogilby 1910; *C. macdonaldi* Oglby 1911; *C. astrinius* Jordan and Jordan 1922; *C. zanectes* Jordan and Jordan 1922; *C. nasutus* McCulloch 1926; *C. rameus* McCulloch 1926; *C. ocelligena* McCulloch 1926; *C. sokonumeri* Kamohara 1936; and there are several species not listed above that probably belong in this genus.

Calliurichthys xanthosemeion Fowler 1925, paratype USNM 109401, from Guam has been examined and is believed to be a distinct species.

In addition de Beaufort refers the following to *Callionymus C. filamentosus* Cuvier and Valenciennes 1837 = *C. longi* Fowler 1941; *C. schaopii* Bleeker 1879; *C. annulatus* Weber 1913; *C. melanopterus* 1850 = *C. fluviatilis* Day 1850; *C. sagitta* Pallas 1770; *C. enneactis* Bleeker 1879; *C. wilburni* Herre 1935; *C. kaianus* Günther 1880. He also includes *Amora tentaculata* Herre, but I refer it to a distinct genus.

Ochiai, Araga, and Nakajima (Publ. Seto Mar. Biol. Lab., vol. 5, No. 1, pp. 96–132, figs. 1–18, 1955) refer the following species to the genus *Callionymus: japonicus* Houttuyn = *numeri* Tanaka; *doryssus* (Jordan and Fowler); *variegatus* Temminck and Schlegel; *calliste* Jordan and Fowler; *phasis* Günther; *planus* Ochiai, Araga, and Nakajima; *sokonumeri* Kamohara; *kaianus* Günther; *flagris* Jordan and Fowler; *punctatus* Langsdorff = *richardsoni* Bleeker; *lunatus* Temminck and Schlegel; *huguenii* Bleeker; *beniteguri* Jordan and Snyder = *ornatipinnis* Regan = *kanekonis* Tanaka; *valenciennesi* Temminck and Schlegel; *flagris* Jordan and Fowler; *lunatus* Temminck and Schlegel; *virgis* Jordan and Fowler; *kitaharai* Jordan and Seale.

The following key differentiates *calliste* and *xanthosemeion:*

1*a*. Eye diameter greater than length of snout, greatest depth of body in head about 2.2 and 6½ to 7 in standard length; cheek with 2 and opercle with 1, vertically elongate black streaks or short lines set in a halo of dark pigment ________________________ **C. calliste** Jordan and Fowler

1*b*. Eye diameter less than length of snout; greatest depth of body 3.2 in head and 9 times in standard length; midside with a series of brown spots and no dark spots or streaks on cheek, vertically elongate.
C. xanthosemeion (Fowler)

CALLIONYMUS CALLISTE Jordan and Fowler

Plate 122,C

Callionymus calliste Jordan and Fowler, Proc. U. S. Nat. Mus., vol. 25, p. 957, fig. 9, 1903 (type locality, Japan; types not seen).

Callionymus hudsoni Fowler, Proc. U. S. Nat. Mus., vol. 90, p. 8, fig. 5, 1941 (type locality, Philippines; type, female, USNM 99412).

Callionymus distethommatus Fowler, Proc. U. S. Nat. Mus., vol. 90, p. 18, fig. 11, 1941 (type locality, Philippines; type, male, USNM 99426).

SPECIMENS STUDIED

Guam: 1945, Frey, 1 specimen, 20 mm.

Description.—Dorsal rays IV–vii,1; anal vi,1; pelvics I,5; pectorals about 18 rays; branched caudal rays 4+3. (See table 119.)

Head to tip of preopercular spine 3.3 greatest depth 6.0, longest ray of pectoral 4.3 and of pelvic fins 3.2; all in standard length. Snout 3.1; eye 2.9; postorbital length of head to tip of preopercular spine 2.0; tip of snout to posterior edge of maxillary 3.0; longest pectoral ray 1.2; longest pelvic ray 0.8; all in length of head to tip of preopercular spine. Least width of interorbital space 9.0 in eye.

Head depressed, snout depressed and slightly concave in front of and between orbits; snout and tip of lower jaw about equal; premaxillaries protractile, when fully retracted not reaching past tip of snout; teeth villiform and in a band in both jaws; no teeth on vomer or palatines; no free dermal flap at rear of opercle; preopercular spine short, with an antrorse spine near the tip hooked outward and probably one or two others broken off on inner side of tip; gill opening above opercle in the form of a small foramen; membrane connecting the pelvic fin with the pectoral base joined on latter opposite middle of base; one simple lateral line; body and head naked.

Color in alcohol.—Background color pale, with about 4 brownish bars on back and sides standing out among irregular darkish mottlings with whitish spots; just below lateral line on sides 3 dark dots, each in brownish blotch; cheek with two short vertical dark lines in a darkish pigment spot, one below middle of eye and the other below rear edge of orbit; a similar black line in a darkish spot on opercle. A small dark pigmented area at corner of mouth, others on snout and under side of head; dorsal caudal, and paired fins finely barred with tiny black spots; anal plain white.

Remarks.—The above described specimen is a female and I am unable to separate it from *C. hudsoni*, the type of which is a female. *C. distethommatus* and *C. calliste* appear to be males of this species. Since I have not examined a type of *calliste* the identification is open to some doubt.

Genus SYNCHIROPUS Gill

Synchiropus Gill, Proc. Acad. Nat. Sci. Philadelphia, 1859, p. 129, 1860 (type species, *Callionymus lateralis* Richardson).

Foetorepus Whitley, Australian Zool., vol. 6, p. 323, 1931 (type species, *C. calauropomus* Richardson).

As a result of my work in connection with identifying the Marshall Islands specimens, I find that *Callionymus splendidus* Herre (Philippine Journ. Sci., vol. 32, p. 416, pl. 2, 1927) has as a synonym *Synchiropus leopoldi* Giltay 1933 (Banda). *C. zaspilus* Herre (Copeia, No. 1, p. 24, 1931), from the Philippines, with 24 pectoral rays, may be a species distinct from *splendidus*, with 29 to 31 rays.

To *C. ocellatus* Pallas 1774, I refer as synonyms: *Synchiropus shoe* Okada and Ikeda 1937, based on an examination of one specimen from Okinawa that agrees with their description; *S. lili* Jordan and Seale 1906, based on a comparison of the holotype USNM 51762, from Samoa, with Philippine specimens of *S. ocellatus; Callionymus rubrovinctus* Gilbert (Bull. U. S. Fish Comm., vol. 23, 1903 pt. 2, p. 650, fig. 252, 1905), doubtfully referred to the synonymy of *C. ocellatus*, based on an examination of the holotype, USNM 51580.

Synchiropus lineolatus (Cuvier and Valenciennes) probably has as synonyms *C. lateralis* Richardson 1844 and *S. ijimae* Jordan and Thompson 1914. In this species the orbit may have a small orbital tentacle, if figures are correct, although that character is not mentioned in the descriptions.

The following additional species from the tropical Indo-Pacific region belong in the genus *Synchiropus: C. calauropomus* Richardson 1894; *S. sechellensis* Regan 1908; *S. pallidus* Fowler 1941, USNM 99437; *S. grinnelli* Fowler 1941, USNM 99436; *S. delandi* Fowler 1941, USNM 99524; *C. bicornis* Norman 1939; *S. ornatus* Fowler 1931; and *C. microps* Günther 1877. *Callionymus altivelis* Temminck and Schlegel (Fauna Japonica, pt. 4, p. 155, pl. 79, fig. 1, 1845), from Japan, must be referred to *Synchiropus*, along with the homonym *S. altivelis* Regan (Trans. Linn. Soc. London, vol. 12, p. 249, pl. 30, fig. 1, 1908, Seychelles)=*S. altivelus* Norman (*in* John Murry Expedition, 1933–34, Scientific Reports, vol. 7, No. 1, Fishes, p. 75, fig. 27, 1939, Gulf of Aden), for which has been proposed the substitute name *S. normani* Schultz and Woods 1949. To this genus *C. picturatus* Peters 1876 also is referred by de Beaufort.

A few other Pacific species, not studied in sufficient detail to allocate them with certainty generically, probably also belong in this genus.

The following key distinguishes the species of the Northern Marshall Islands and Marianas Islands:

1*a*. Pectoral rays 17 to 22.

  2*a*. Pectoral rays 17 or 18; dorsal 9; anal 8; no ocelli in spiny dorsal fin; a tiny black dot at lower part of pectoral base and another on branchiostegals of males; females mostly unpigmented; usually 4 or 5 spiny points on preopercular spine________________S. laddi, new species

- 2*b*. Pectoral rays 19 to 22; dorsal 8; anal 7; usually 2 or 3 spiny points on preopercular spine.
  - 3*a*. Spiny dorsal fin with 3 or 4 distinct black ocellate spots; characteristic dark brown and white bars on body__________**S. ocellatus** Pallas
  - 3*b*. Spiny dorsal without black ocellate spots, instead narrow black streaks mostly parallel with fin rays; head and body with numerous brown spots but body lacking dark brown and white bars. **S. morrisoni**, new species
- 1*b*. Pectoral rays 23 to 32.
  - 4*a*. Pectoral rays 23 or 24__________________________**S. delandi** Fowler and **S. zaspilus** (Herre)
  - 4*b*. Pectoral rays 29 to 32__________________________**S. picturatus** (Peters) and **S. splendidus** (Herre)

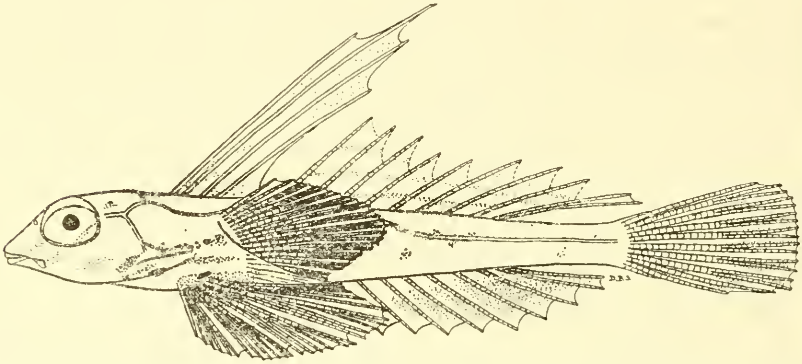


FIGURE 131.—*Synchiropus laddi*, new species, holotype, USNM 141127, from Bikini Atoll. Drawn by Dorothea B. Schultz

SYNCHIROPUS LADDI, new species

FIGURE 131

Holotype.—USNM 141127, a male specimen, 24.3 mm., standard length, from Bikini Atoll, Bikini Island, ocean reef, March 22, S–46–15, Schultz and Brock.

Paratypes.—USNM 141128, Bikini Atoll, Cherry Island, ocean reef, April 18, S–46–98, Schultz, 2 specimens, 8 to 14 mm.; USNM 141129, Bikini Atoll, Reere Island, lagoon reef, August 12, S–36–332, Herald and Brock, 1 specimen, 23mm.; USNM 141130, Rongelap Atoll, Yugui Island, ocean reef, July 31, S–46–304, Herald, 2 specimens, 15 and 16 mm.; USNM 141132, Rongerik Atoll, Bock Island, ocean reef, June 27, S–46–237, Schultz and Herald, 8 specimens, 15 to 22 mm.; USNM 141131, Eniwetok Atoll, Rigili Island, lagoon reef, May 30, S–46–189, Schultz, 1 specimen, 20 mm.

Description.—The following counts were made on the holotype and paratype, respectively: Dorsal rays IV–viii,1 and IV–viii,1; anal vii,1 and vii,1; pectoral ii,16–ii,16 and ii,15–ii,15; pelvics I,5 and I,5; branched caudal 4+3 and 4+3; pelvic membrane attached to opposite base of 5–5 and 4–4 pectoral rays counting from dorsal edge of pectoral fin; number of dorsal and terminal spines on preopercular spine 5+5 and 4+4. (See table 119.)

The following precision measurements were made on the holotype and one female paratype and these data are recorded in thousandths of the standard length, 24.3 and 18.7 mm., respectively: Length of head from tip of snout to rear tip of preopercular spine 313 and 305; greatest depth of body 144 and 123; least depth of caudal peduncle 66 and 59; snout 82 and 96; bony interorbital space 8 and 11; eye 95 and 96; postorbital length of head to rear tip of preopercular spine 140 and 134; length of caudal peduncle from base of last anal ray to midbase of caudal fin 202 and 214; snout tip to origin of first dorsal 288 and 300 and to anal origin 535 and 535; length of first dorsal spine 535 and 182; longest soft dorsal ray 272 and 150; longest pectoral ray 267 and 251; longest pelvic ray 333 and 364; longest caudal fin ray 300 and 273; tip of snout to rear edge of maxillary 82 and 75; length of preopercular spine from its dorsal base to the tip 66 and 64.

Head depressed, snout with moderately steep profile, flattish dorsally; premaxillary retracts so that it is equal with tip of snout; teeth in a villiform band on both jaws, wider near tips; no teeth on vomer or palatines; no free dermal opercular flap; preopercular spine moderately long, with 3 or 4 small spines on dorsal edge in addition to the terminal tip which curves or is hooked dorsally; no basal antrorse spine on preopercular spine; gill opening a small foramen on dorsal side of opercule; the membrane connecting pelvic fin with pectoral base does so opposite base of fourth or fifth (rarely third) ray from dorsal edge of pectoral fin; lateral line single, simple, dorsally located and arched over length of pectoral fin; maxillary at rear edge not semitubular in shape, and no lobe; no orbital tentacle.

Color in alcohol.—Males are plain pale with a few dark pigment spots on sides, sometimes indistinct; 2 pairs of tiny black dots are persistent and very characteristic, one below base of preopercular spine between fourth and fifth branchiostegal rays, the other on lower part of pectoral fin base a little behind and above base of last pelvic ray; sides of head and branchiostegal membranes with 8 rather indistinct lines of dark pigment; cheek with two dark pigmented areas, and another just behind and below rear corner of maxillary; upper part of pectoral base with a darkish pigmented spot; soft dorsal fin with lengthwise dark streaks; spiny dorsal with dark pigment streaks, more or less parallel with rays; anal darkish; caudal with scattered dark pigment. Females plain pale, scarcely any traces of pigment where the most distinct marks occurred on the males.

TABLE 119.—*Counts made on certain species of* Callionymidae

Species	Fin rays													Spiny points on preopercular spine								Pelvic fin membrane joins opposite base of pectoral ray from dorsal edge									
	Dorsal				Anal			Pectoral																							
	IV	7	8	9	6	7	8	17	18	19	20	21	22	2	3	4	5	6	7	8	9	3	4	5	6	7	8	9	10	11	12
Diplogrammus goramensis	7	1	6		1	6		3	8	1								1	2	5	3	2	4	2							
Synchiropus laddi	4			4			4	3	2						1	4	3						6	4							
Synchiropus morrisoni	1		1			1						2			2															1	1
Synchiropus ocellatus	3		3			3				2	3	1	1	7	1											1	2	2	1		
Callionymus calliste	1		1			1			1						1																

Ecology.—This species occurred on the reefs associated with coral heads and sandy bottoms.

Remarks.—This is the only species of *Synchiropus* with two distinctive and persistent tiny black spots on males, one on membrane between branchiostegal rays 4 and 5 and the other at lower base of pectoral fin, along with 9 soft dorsal and 8 anal rays.

Named in honor of Dr. H. S. Ladd, U. S. Geological Survey, who was at Bikini in 1946 and again in 1947.

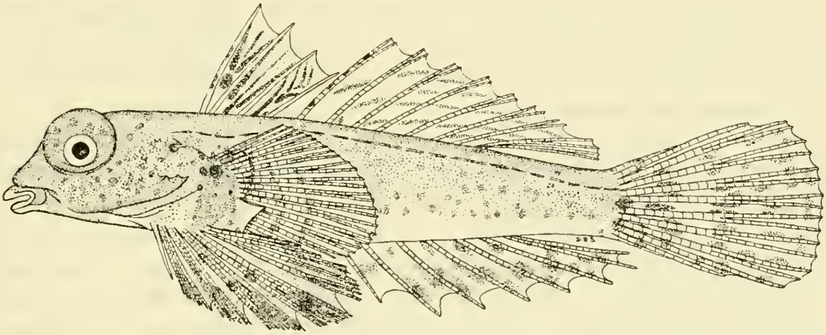


FIGURE 132.—*Synchiropus morrisoni*, new species, holotype, USNM 141126, from Bikini Atoll. Drawn by Dorothea B. Schultz.

SYNCHIROPUS MORRISONI, new species

FIGURE 132

Holotype.—USNM 141126, a female 43 mm. in standard length, Bikini Atoll, Arji Island, lagoon coral head, 20 to 40 feet depth, August 7, S–46–308, Herald and Brock.

Description.—Only specimen known, dorsal rays IV–8; anal vi,1; pectoral ii,19,i–iii,17,i; pelvics I,5; branched caudal 4+3; pelvic membrane connects with pectoral base opposite eleventh or twelfth ray from dorsal edge of base; number of dorsal and terminal spines on preopercular spine 3+3. (See table 119.)

The following precision measurements made on the holotype are expressed in thousandths of the standard length which is 43 mm.: Length of head from tip of snout to rear tip of preopercular spine 320; greatest depth of body 186; least depth of caudal peduncle 105; snout 81; bony interorbital space 19; eye 105; postorbital length of head to rear tip of preopercular spine 167; length of caudal peduncle from base of last anal ray to midbase of caudal fin 198; snout tip to origin of first dorsal 319; snout to anal origin 534; length of first dorsal spine 202; longest soft dorsal ray 198; longest pectoral ray 253; longest pelvic ray 307; longest caudal ray 349; tip of snout to rear edge of maxillary 81; length of preopercular spine from its dorsal base to the tip 77.

Head depressed, snout with steep profile, slightly concave just in front of and between eyes; premaxillary retracts so that snout tip and front of premaxillary are equal; teeth in a villiform band in both jaws, this band widest at front of jaws; vomer and palatines edentulous; no free dermal flap at rear of opercle; preopercular spine moderately elongate, with 2 dorsally directed spines and the terminal preopercular point curved a little upward on one side, straight on the other; no antrorse basal spine on preopercular spine; gill opening a small foramen on dorsal side of opercle; the membrane connecting pelvic with pectoral base joins opposite eleventh or twelfth rays downward from dorsal edge of pectoral fin; lateral line single and simple, running a dorsally located course; maxillary at rear edge not semitubular with a lobe; no orbital tentacle.

Color in alcohol.—Background color pale brownish, head and body spotted everywhere with numerous small, distinct dark brown spots; under side of head light brownish; cheeks with a few brown spots; pelvic fin with two brownish cross bands and some brown specks; pectoral irregularly barred; spiny dorsal with alternating vertical pale and black streaks; soft dorsal with lengthwise dark brown or black streaks; anal and caudal fins barred with dark brown spots; pectoral base blackish.

Ecology.—This specimen was found in 20 to 40 feet of water, over a sand and coral-head bottom.

Remarks.—This species is nearest *ocellatus* but differs in lacking black ocellated spots in the dorsal fin and lacks the distinct brown and white bars on the body found in that species. The membrane from pelvic fin connects opposite base of the eleventh and twelfth pectoral rays from dorsal edge in *morrisoni* instead of the seventh to tenth as in *ocellatus*. Soft dorsal rays 8, and anal 7, in *morrisoni* whereas in *laddi* they are 9 and 8 respectively.

Named in honor of Dr. J. P. E. Morrison, associate curator of mollusks, U.S. National Museum, who spent the summers of 1946 and 1947 at Bikini.

Suborder SCOMBRINA

Family SCOMBRIDAE: Tunas

By LEONARD P. SCHULTZ

The following key should be useful in identifying the tuna and tuna-like fishes of the northern Marshall Islands:

1*a*. Two lateral lines; dorsal rays about XII,III, 6 to 8–7; anal about III,8 or 9–6; pectoral rays ii,23 or 24; gill rakers about 4+1+15; vomer, palatines, and tongue with a large patch of villiform teeth.
Grammatorcynus bilineatus (Rüppell)

1*b*. A single lateral line more or less running a dorsal course.

2*a*. Body greatly elongate, greatest depth about 6 to 7 and head 4 to 5 in length to fork of tail; dorsal rays about XXIV,III,8–9; anal about III,8–9; pectoral about ii,20; gill rakers represented by rough places on gill arch, none elongate; sides of body with numerous narrow pale or whiteish bars indistinct dorsally; skin very finely scaled; vomer and palatines with villiform patches of teeth, none on tongue; teeth in jaws, triangular, very close-set.
Acanthocybium solandri (Cuvier and Valenciennes)

2*b*. Greatest depth of body fewer than 6 and head fewer than 4.5 in length to fork of tail; dorsal spines about XII to XV.

3*a*. Tongue toothless, each side with a low but distinct cutaneous fold, with space between concave; soft dorsal and anal fins not white tipped.

4*a*. Lower sides silvery with 4 or more dark streaks, or bands; back usually with some short vertical pale bars; vomer toothless, palatines with a row of fine teeth; gill rakers on first gill arch about 18+1+37; pectoral rays about ii,26.
Katsuwonus pelamis (Linnaeus)

4*b*. Lower sides without dark lengthwise streaks, or bands; gill rakers on first gill arch 7 or 8+1+20 to 25.

5*a*. Usually numerous pale or whitish narrow vertical lines or bars, or a series of white dots on sides; fins bright yellow; gill rakers usually 8+1+20 to 22; dorsal rays XIII–III,11 or 12–9; anal III,10–8; pectoral rays ii,33 to 35; vomer with a patch of villiform teeth, those of palatines in a single or very narrow row; pectoral fin length 3 to 3½ in standard length.
Neothunnus albacora macropterus (Temminck and Schlegel)

5*b*. No vertical pale lines or bars; obliquely ascending dark bands above lateral line; area between pectoral and pelvic fins usually with 1 to 5 black spots; a black blotch below border of eye; gill rakers 7 or 8+1+24 or 25; dorsal rays XV–III,8 or 9–8; anal III,10–7; vomer and palatines with a few tiny teeth in a single or very narrow row; pectoral fin length 6 to 6½ in standard length.
Euthynnus affinis yaito Kishinouye

3*b*. Tongue with a villiform patch of teeth on each side of a naked midline; no cutaneous fold on tongue; fins generally blackish with a white tip on soft dorsal and anal fin; no pale or dark streaks on body; gill rakers about 1+1+11; dorsal rays XV,III,10–7; anal III,10–6; pectoral rays about ii,25; vomer toothless; palatines with villiform teeth------------------------------**Gymnosarda nuda** Günther

Genus GRAMMATORCYNUS Gill

Grammatorcynus Gill, Proc. Acad. Nat. Sci. Philadelphia, p. 125, 1862 (type species, *Thynnus bilineatus* Rüppell).

GRAMMATORCYNUS BILINEATUS (Rüppell)

Plate 123,A

Thynnus bilineatus Rüppell, Neue Wirbelthiere zu der Fauna von Abysinnien gehörig, Fische, p. 39, pl. 12, fig. 2, 1835 (type locality, Red Sea).

SPECIMENS STUDIED

Northern Marshall Islands, 1946, commercial fishermen, 4 specimens, USNM 140986, 490 to 590 mm. to fork of caudal fin, saved from the ship wrecked in Halfmoon Bay, Calif. (see vol. 1, p. xxi), now in a very poor state of preservation.

Bikini Atoll, Lagoon off Bikini Island to entrance at Enyu Island, hook and line, March 11 to 31, S–46–2, Brock, Marr, Schultz, and crew of U. S. S. *Bowditch*, 2 specimens, 485 and 525 mm.; Bikini lagoon, general region of channels to leeward, trolling, hook and line, and spearing, April 1 to May 7, S–46–72, crew, officers, scientists on U. S. S. *Bowditch*, 5 specimens, USNM and CNHM, 403 to 477 mm.; Ruji Channel, surface trolling, April 6, S–46–90, Brock, 1 specimen, 400 mm.

Description.—Dorsal rays XII,III, 6 to 8–7; anal rays III,8 or 9–6; pectoral ii,23 or 24; pelvics I,5; gill rakers 4+1+15 on first gill arch.

Greatest depth 4.8 to 5.3; length of head 4.5 to 4.8; length of pectoral fin 8.2 to 8.8; length of base of first dorsal 3.9 to 4.3; snout tip to soft dorsal origin 1.7 to 1.8; all in length from tip of snout to fork of caudal fin, or "crutch." Eye 4.5 to 4.7; snout 2.6 to 2.7; tip of snout to rear of maxillary 2.1; interorbital space 3.0 to 3.2; length of pectoral fin 1.7 to 1.8; longest (first) dorsal spine 2.5 to 3.0; longest soft dorsal ray 2.6, soft analray 2.5; longest pelvic ray 2.9 to 3.0; all in length of head to rear edge of fleshy operculum.

Body elongate, fusiform, skin with scales; corselet indistinct; both jaws with strong teeth; a large villiform patch of teeth on vomer and palatines; tongue with a large villiform patch of teeth; two lateral lines, the dorsal one extending from upper edge of gill opening along contour of back, the ventral one abruptly curving downward under pectoral fin then following the ventral contour of body to base of caudal peduncle; first or second dorsal spine longest; posterior margin of preopercle concave; maxillary reaches to opposite front of pupil; interorbital space first convex, then central part a little concave; diameter of eye along the lengthwise axis of body 2.8 to 3.1 in length of pectoral and 2.0 to 2.2 in length of maxillaries.

Color in alcohol.—Back blackish to bluish, paler ventrally.

Genus ACANTHOCYBIUM Gill

Acanthocybium GILL, Proc. Acad. Nat. Sci. Philadelphia, vol. 14, p. 125, 1862 (type species, *Cybium sara* Bennett).

ACANTHOCYBIUM SOLANDRI (Cuvier and Valenciennes)

PLATE 121,B

Cybium solandri CUVIER and VALENCIENNES, Histoire naturelle des poissons, vol. 8, p. 192, 1831 (type locality, open seas).

SPECIMENS STUDIED

Northern Marshall Islands, 1946, commercial fishermen, 8 specimens, USNM 140979. Only the 8 heads were saved from the wrecked ship in Halfmoon Bay, Calif. (see vol. 1, p. xxi), and these were in a bad state of preservation; thus, it was not possible to compare *A. cybium* with *A. forbesi* Seale from the Philippines and determine if it represents another species.

Marianas Islands, Rota Island, off Sosan Isthmus, October 1945, Markley, 1 specimen, USNM 123740, 930 mm.

Description.—(Rota Island specimen): Dorsal rays XXIV,III,8–9; anal III,8–9; pectoral ii,20; pelvics I,5; gill rakers on first gill arch undeveloped.

Greatest depth 6.7; length of head 4.6; length of pectoral fin 9.7; length of base of first dorsal 2.8; snout tip to soft dorsal origin 1.6; all in length from tip of snout to fork of caudal fin, or "crutch." Eye 9.2; snout 2.0; tip of snout to rear of maxillary 2.0; interorbital space 3.8; length of pectoral fin 2.2; longest dorsal (second) spine 3.3; longest soft ray of dorsal 4.5; and of anal 4.5; longest pelvic ray 3.8; all in length of head to rear edge of fleshy operculum.

Body greatly elongate, fusiform, skin with extremely minute scales, corselet around pectoral fin and on back; both jaws with strong, close-set triangular teeth; vomer and palatines each with an elongate patch of villiform teeth; tongue flat, broad, without teeth; lateral line single, abruptly decurved behind pectoral fin, thence extending along mid-axis of body in a more or less wavy course; dorsal spines not abruptly shorter posteriorly; the second or longest is only a little longer than sixth from last; posterior margin of preopercle truncate and coarsely fringed; maxillary reaches to under front of eye; interorbital strongly convex; diameter of eye along the lengthwise axis of body 4.0 in the length of pectoral fin and 4.7 in length of maxillaries.

Color in alcohol.—Back blackish to bluish black; sides with numerous pale or whitish vertical bars, fading dorsally.

Genus KATSUWONUS Kishinouye

Katsuwonus Kishinouye, Suisan Gakkwai Ho (Proc. Sci. Fish. Assoc.) vol. 1, p. 21, 1915 (type species, *Scomber pelamis* Linnaeus).

KATSUWONUS PELAMIS (Linnaeus)

Plate 122,B

Scomber pelamis Linnaeus, Systema naturae, ed. 10, p. 297, 1758 (type locality, tropical seas).

SPECIMENS STUDIED

Although numerous specimens of this species were taken, all but one were lost in the ship wrecked in Halfmoon Bay, Calif. (See vol. 1, p. xxi), and that specimen was so badly disintegrated that it was destroyed.

Description.—(Based on a specimen from Japan): Dorsal rays XV,III,12–8; anal III,12–7; pectoral ii,26; pelvics I,5; gill rakers on first gill arch 18+1+37. Greatest depth 4.0; length of head 3.7; length of pectoral fin 8.0; length of base of first dorsal fin 4.0; snout tip to soft dorsal origin 1.7; all in length to fork of tail. Eye 6.5;

snout 3.5; tip of snout to rear of maxillary 2.7; interorbital space 3.9; length of pectoral fin 2.2; longest (first or second) dorsal spine 2.2; longest soft dorsal ray 3.9, soft anal ray 4.1; longest pelvic ray 2.5; all in length of head to rear edge of fleshy operculum.

Body fusiform, skin smooth, naked except for corselet, which occurs on breast, around pectoral fin to spiny dorsal, thence to front of soft dorsal; teeth in jaws small numerous, hooked inward; vomer toothless; palatines with tiny teeth in a single row or a very narrow band; tongue toothless, with a low cutaneous fold on each side, space between concave; lateral line arched and curving to midlengthwise axis of body opposite base of soft dorsal; margin of preopercle rounded; maxillary reaches nearly to opposite front of pupil; interorbital space strongly convex; diameter of eye 3.0 in pectoral fin and 2.5 in maxillaries.

Color in alcohol.—Back bluish black, with some light-colored vertical bars; lower sides silvery with a few lengthwise dark streaks or bands slanting dorsally towards caudal peduncle.

Genus **NEOTHUNNUS** Kishinouye

Neothunnus KISHINOUYE, Journ. Coll. Agr. Imp. Univ., Tokyo, vol. 8, No. 3, p. 445, 1923 (type species, *Thynnus macropterus* Temminck and Schlegel).

NEOTHUNNUS ALBACORA MACROPTERUS (Temminck and Schlegel)

PLATE 122,A

Thynnus albacora LOWE, Proc. Zool. Soc. London, p. 77, 1839 (Madeira).

Thynnus macropterus TEMMINCK AND SCHLEGEL, Fauna Japonica, pt. 3, p. 98, pl. 51, 1844 (type locality, Nagasaki).

SPECIMENS STUDIED

Tropical North Pacific Ocean, lat. 20°17′45″ N., long. 162°28′45″ W., March 2, 1946, S–46–1, commercial fishermen on U.S.S. *Bowditch*, 1 specimen USNM 140984, 450 mm. to fork of caudal fin, or "crutch."

Bikini Atoll, Lagoon and leeward channels, April 1–24, S–46–72 crew of U.S.S. *Bowditch* and Schultz, 1 specimen USNM 140985, 600 mm.

Marianas Islands, Rota Island, November 15, 1945, Frey, 1 specimen USNM 139875, 610 mm.

A few specimens were rescued from the ship wrecked in Halfmoon Bay, Calif., (see vol. 1, p. xxi). Most were discarded in various stages of disintegration, but several, useful for skeletons, were saved and these bear the number USNM 111430.

Description.—Dorsal rays XIII–III,11 or 12–9; anal III,10–8; pectoral ii,33 to 35; pelvic I,5; gill rakers on first gill arch 8+1+21 or 22. Greatest depth 4.0 to 4.3; length of head 3.6 to 3.7; length of pectoral fin 3.5 to 3.8; length of base of first dorsal fin 4.4 to 4.5; snout tip to soft dorsal origin 1.7 to 1.8; all in length from tip of snout to fork of caudal fin, or "crutch." Eye 5.6 to 6.7; snout 3.0 to 3.1;

tip of snout to rear of maxillary 2.5 to 2.6; interorbital space 2.8 to 3.2; length of pectoral fin 1.0 to 1.1; longest (first) dorsal spine 2.3 to 2.4; longest soft dorsal ray 2.4, soft anal ray 2.3 to 3.2; longest pelvic ray 3.0; all in length of the head to rear edge of fleshy operculum.

Body fusiform, skin with very fine scales, head naked; teeth in both jaws small, conical, somewhat hooked inward; vomer with a patch of villiform teeth, those of palatines in a narrow row; tongue naked, with a low cutaneous fold on each side, space between concave; lateral line running a slanting, even course from above pectoral to midside of caudal peduncle; posterior margin of preopercle truncate with lower corner rounded; maxillary reaches to about opposite front of pupil; interorbital space strongly convex; diameter of eye along lengthwise axis of body 5 to 6½ times in length of pectoral fin and 2.0 to 5.8 in maxillaries.

Color in alcohol.—Back and upper sides dark bluish or black, lower sides dusky to whitish; numerous more or less distinct, narrow, pale, slightly oblique lines or a series of white dots.

Color when alive.—Eye yellow, spiny dorsal grayish yellow; soft dorsal and anal and all finlets bright yellow; inside of pectorals black, outer side blackish tinged with yellow; pelvics yellowish, tipped with blackish.

Genus EUTHYNNUS Lütken

Euthynnus Lütken, *in* Jordan and Gilbert, U. S. Nat. Mus. Bull. 16, p. 429, 1882 (type species, *Thynnus thunnina* Cuvier and Valenciennes).

EUTHYNNUS AFFINIS YAITO Kishinouye

Plate 123,C

Euthynnus yaito Kishinouye, Suisan Gakkwai Ho (Proc. Sci. Fish. Assoc.) vol. 1, p. 22, pl. 1, fig. 15, 1915 (Japan).

SPECIMENS STUDIED

Bikini Atoll: Lagoon and Enyu Channel, trolling, March 11–31, S–46–2, Brock, Marr, and Schultz, 1 specimen USNM 140981, 350 mm. to fork of tail, a female bulging with mature eggs; lagoon and channels on leeward side, April 1–24, S–46–72, crew of U. S. S. *Bowditch* and Schultz, 2 specimens USNM 140982, 355 and 520 mm.; western half of lagoon, trolling, April 13, S–46–93, Schultz, 2 specimens USNM 140983, 360 and 550 mm.

In addition we have discarded several specimens in various stages of disintegration rescued from the ship wrecked in Halfmoon Bay, Calif. (see vol. 1, p. xxi), but saved a few dried ones useful for skeletons; these bear the number USNM 111429.

Description.—Dorsal rays XV–III,8 or 9–8; anal III,10–7; pectoral ii,26 or 27; pelvic I,5; gill rakers on first gill arch about 7 or 8+1+24 or 25; greatest depth 3.8 to 4.0; length of head 3.6 to 3.7; length of pectoral fin 6.0 to 6.3; length of base of first dorsal 3.9 to 4.1; snout tip to soft dorsal origin 1.7; all in length from tip of snout to fork of caudal fin or "crutch." Eye 6.0 to 8.0; snout 3.3 to 3.4; tip of snout to rear of maxillary 2.5 to 2.7; interorbital space 3.3 to 3.4; length of pectoral fin 1.7 to 1.8; longest (first) dorsal spine 2.0; longest soft dorsal ray 3.5 to 4.9, soft anal ray 3.7 to 4.9; longest pelvic ray 2.6 to 2.8, all in length of head to rear edge of fleshy operculum.

Body fusiform, skin smooth except for corselet, which occurs from breast around pectoral fin base and groove for pectoral fin to spiny dorsal, thence along middle of back to soft dorsal; lower jaw with small conical, somewhat hooked teeth; vomer and palatines with a few villiform teeth in a single or narrow row; tongue toothless but with a cutaneous fold on each side, concave between; lateral line a little arched over pectoral, then running a slanting course to caudal peduncle, with a few scales above and below; first spine of dorsal longest; preopercular margin evenly rounded posteriorly; maxillary reaches to opposite front of pupil; interorbital space strongly convex; diameter of eye (along lengthwise axis of body) 3.4 to 4.6 in length of pectoral and 2.3 to 3.0 in length of maxillaries.

Color in alcohol.—Back dark blue to blackish dorsally with black oblique bands, mostly above lateral line; lower sides silvery to whitish; area between pectoral and pelvic fins with 1 to 5 black spots; pectoral fin black; pelvics black, their posterior margins and tips white; just below eye a blackish area; rear edge of maxillary groove black.

Remarks.—Fraser-Brunner (Ann. Mag. Nat. Hist., ser. 12, vol. 2, pp. 622–627, 1949) recognizes two separate species for the genus *Enthynnus*, one, *affinis*, in the Indo-Pacific, of which there are three subspecies: *E. affinis affinis* (Cantor) from the Red Sea and the Indian Ocean to the East Indies and Australia; *E. affinis yaito* Kishinouye, from Japan, Hawaii and the Pacific Islands; and *E. affinis lineatus* Kishinouye, from the Pacific ocean of Central America. In the Atlantic he recognizes *E. alletteratus alletteratus* Rafinesque from the North Atlantic and *E. alletteratus aurolitoralis* Fraser-Brunner from the Gold Coast.

Genus GYMNOSARDA Gill

Gymnosarda GILL, Proc. Acad. Nat. Sci. Philadelphia, p. 125, 1862 (type species, *Thynnus unicolor* Rüppell).

GYMNOSARDA NUDA Günther

PLATE 123,B

Pelamys nuda GÜNTHER, Catalogue of the fishes in the British Museum, vol. 2, p. 368, 1860 (type locality, Red Sea).

SPECIMENS STUDIED

Bikini Atoll: Eastern end of lagoon and in Enyu Channel, March 11–31, S-46-2, Brock, Marr, and Schultz, 6 specimens USNM 140980, 410 to 790 mm. in length to fork of caudal fin or "crutch."

In addition to the well preserved specimens listed above, there were discarded more than 35 specimens in various stages of disintegration rescued from the ship wrecked in Halfmoon Bay, Calif. (see vol. 1, p. xxi). Among these dried specimens we have saved a few of the best; they bear the number USNM 111428.

Description.—Dorsal rays XV–III,10–7; anal III,10–6; pectoral ii,25; pelvic I,5; gill rakers on first gill arch 1+1+11; teeth lower jaw 13 to 18, upper jaw 16 to 23.

Greatest depth 4.5 to 4.8; length of head 3.8 to 4.0; length of pectoral fin 6.0 to 6.5; length of base of first dorsal 3.6 to 3.7; snout tip to soft dorsal origin 1.7 to 1.8; all in length from tip of snout to fork of caudal fin or "crutch." Eye 4.2 to 5.6; snout 2.5 to 2.6; tip of snout to rear of maxillary 1.9 to 2.0; interorbital space 2.5 to 2.6; length of pectoral fin 1.7 to 1.8; longest (third) dorsal spine 3.6 to 3.7, longest soft dorsal ray 2.8 to 3.1, soft anal ray 2.7 to 3.3; longest pelvic ray 2.7 to 2.9, all in length of head to rear edge of fleshy operculum.

Body fusiform, skin smooth except for corselet around pectoral base, above it, and along back; lower jaw broad, heavy, with rather large teeth, these a little heavier in lower than in upper jaw; vomer toothless, villiform teeth on palatines, and a villiform patch of teeth each side of midline of tongue; lateral line extending over pectoral in a slight curve downward to below rear of base of soft dorsal, then opposite first two dorsal finlets with a wave or two, thence curving upward to midlengthwise axis just in front of caudal keel and about opposite the third anal finlet; a few scales above and below the lateral line, and caudal keel scaly; third spine of dorsal longest; preopercular margin with a concavity in its posterior margin; maxillary reaches to opposite middle of eye; interorbital though a little convex is flattish; eye large, 2.2 in length of pectoral and 2.2 in length of maxillaries.

Color in alcohol.—Back dark blue or blackish, whitish underneath; fins blackish, tips of soft dorsal and anal white, posterior margin of pelvics white-edged.

Ecology.—This species was the most frequently caught of all the tuna in the Northern Marshall Islands, being especially abundant in the entrances into the lagoon. It was usually from 2 to 3 feet long and many were 4 feet in length. During the spring it was in a spawning condition. Frequently it had *Caesio* and *Pterocaesio* in its stomach when caught.

Remarks.—This tuna was given the name dogtooth tuna by the commercial fishermen because it had teeth larger than those of any other species of tuna caught at Bikini during "Operation Crossroads."

Suborder STROMATEINA

Family STROMATEIDAE: Butterfishes

By Leonard P. Schultz

Genus PSENES Cuvier and Valenciennes

Psenes Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 9, p. 259, 1833 (type species, *Psenes cyanophrys* Cuvier and Valenciennes).

Considerable time has been spent in an attempt to identify the specimen of *Psenes* in these collections but descriptions are too brief and inadequate in the literature to enable me to come to a satisfactory conclusion as to the correct scientific name to apply to this specimen. Since this genus has never been revised and the specimens and species available to me are not in sufficient numbers to make it worthwhile to revise this genus, I have identified it only to the genus.

PSENES sp.?

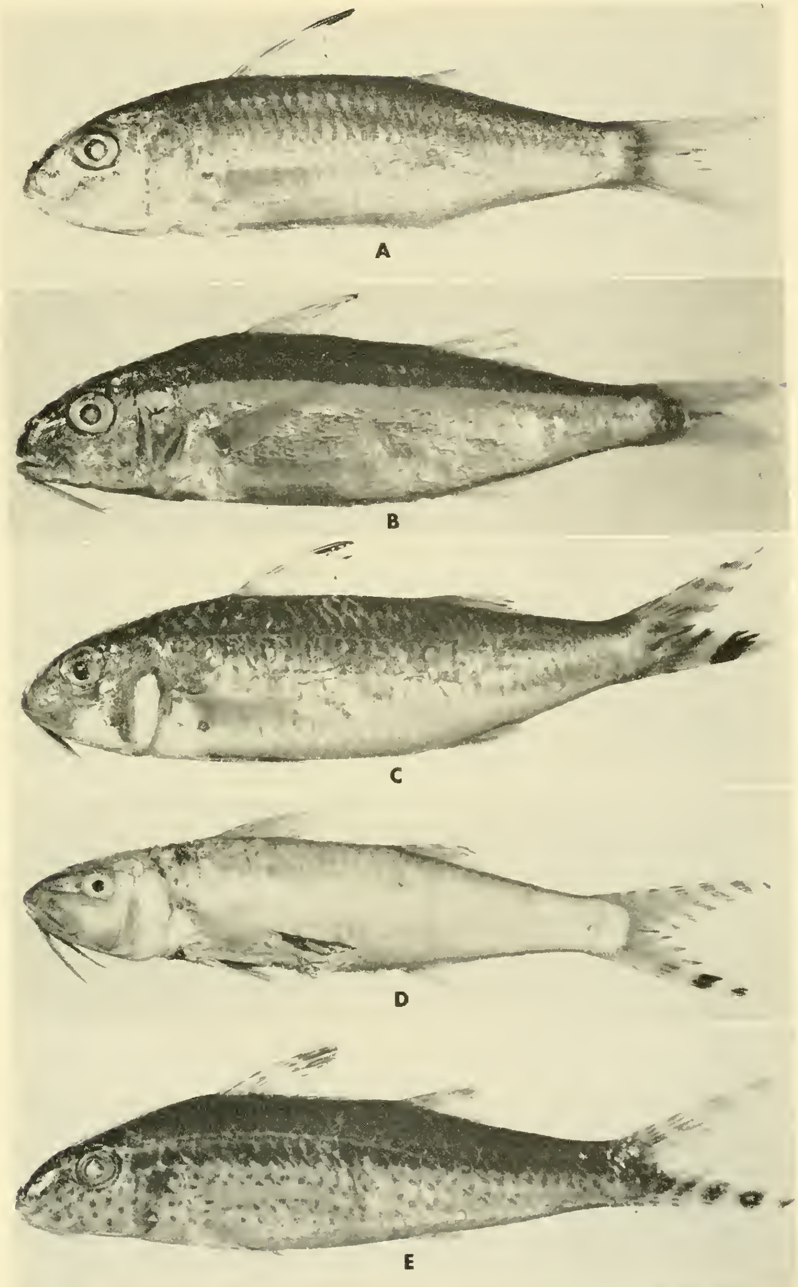
SPECIMEN STUDIED

Marshall Islands: Lat. 09°00′ N.; Long. 168°00′ E., U.S.S. *Laffey*, 1946 M. W. Johnson, 30 mm. in standard length.

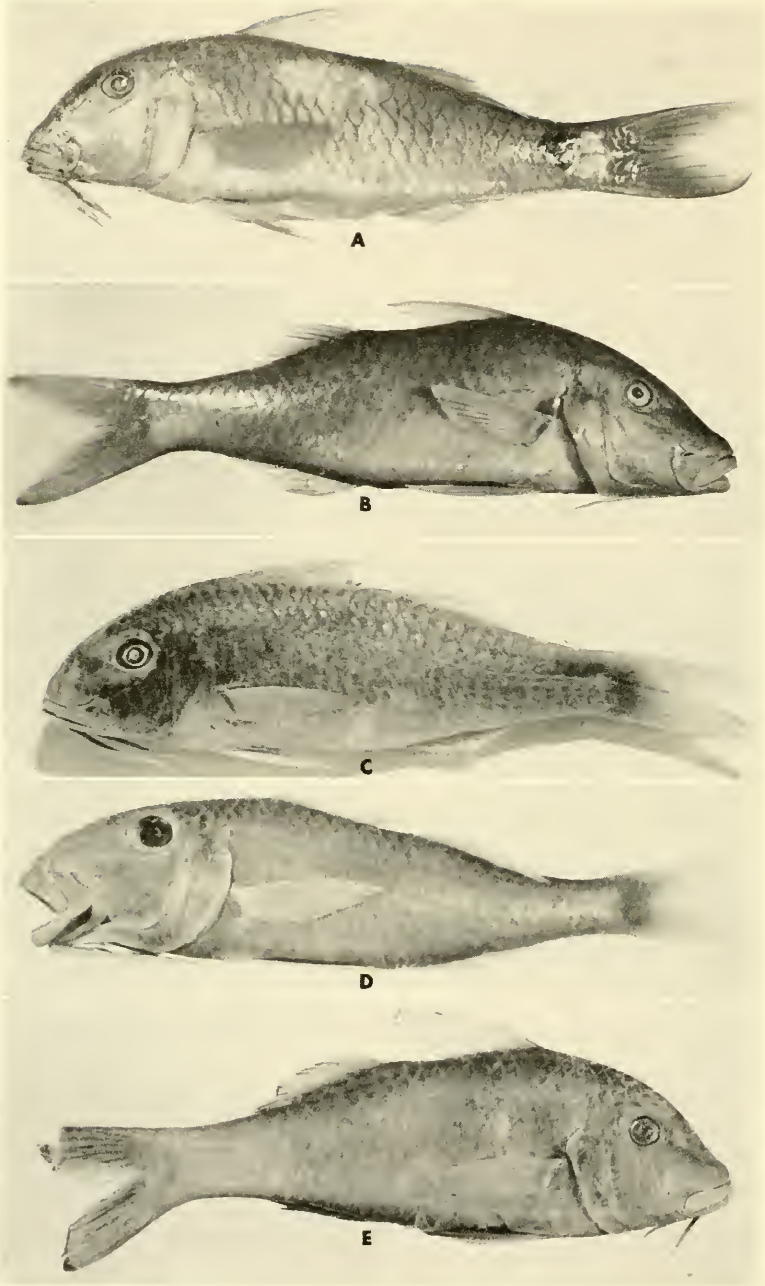
Description.—Dorsal IX,I,24; anal III,24, scales rows crossing lateral line 61 or 62, with 9 scales from lateral line to dorsal origin and 21 scales from lateral line to anal origin; pectoral rays ii,17–ii,17; gill rakers 8+1+18. Depth 1.8; head 2.7; both in standard length. Eye 3 in head.

Color in alcohol.—Background light brown; pelvics blackish; first dorsal blackish.

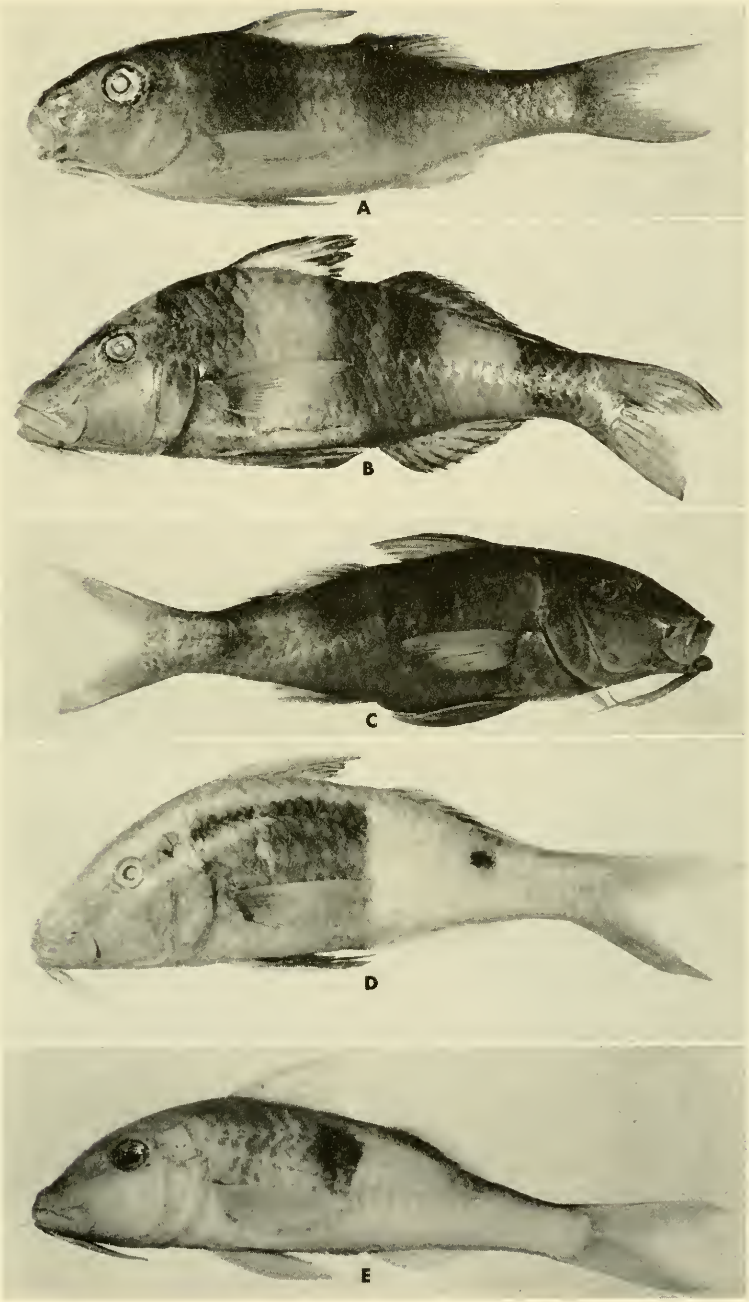
Remarks.—Cuvier and Valenciennes described *Psenes guamensis* from Guam. They record the fin rays as: Dorsal IX,I,22; anal "2/29" which may be III,28; caudal 17; pectoral 19; pelvics I,5. The number of scales are not given. The figure of 28 or 29 soft rays in the anal fin is too many to identify our specimen with *guamensis*. Two other species may be close to this Marshall Island specimen: One is *Psenes chapmani* Fowler from the Atlantic which is said to have 60 scale rows, dorsal rays X,I,23, and anal rays III,25; the other is *P. maculatus* Lütken, also of the Atlantic with about the same number of fin rays.



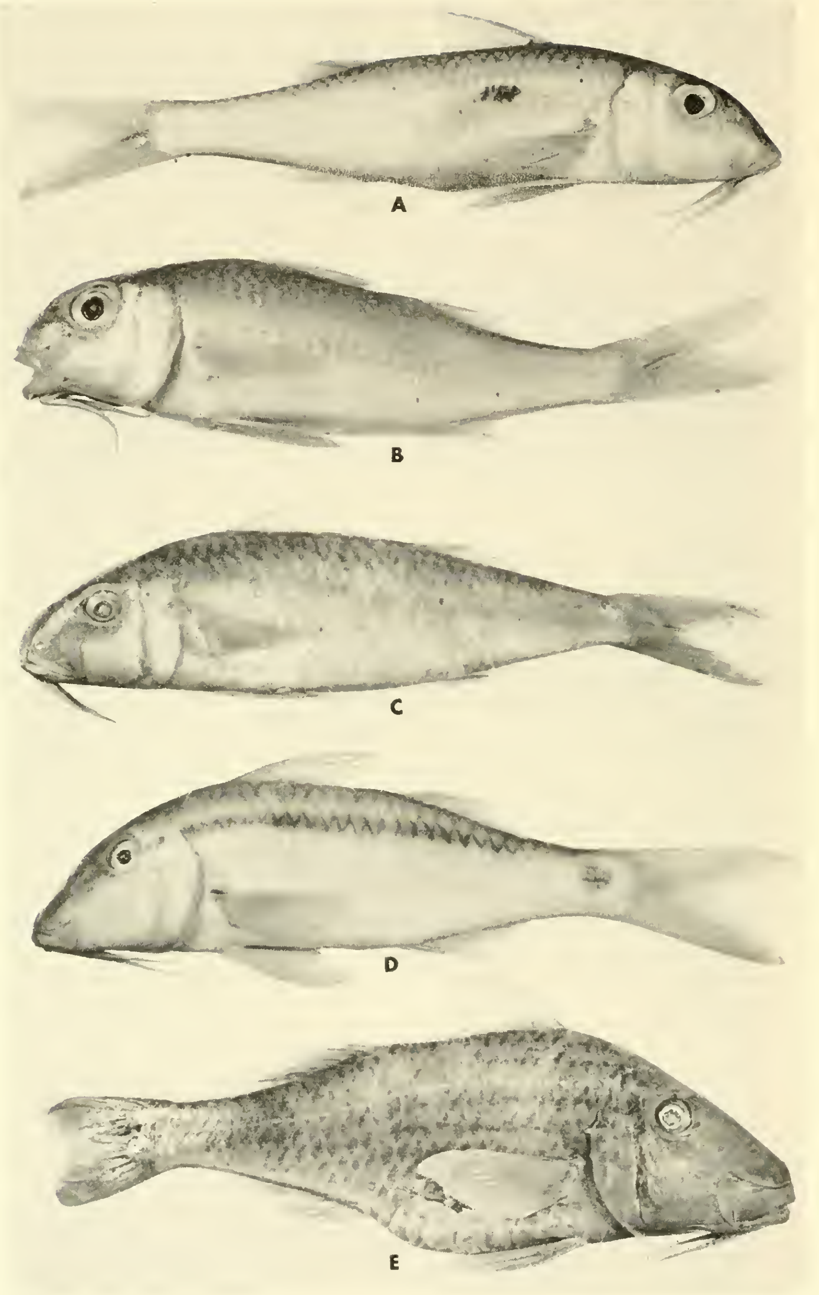
A, *Upeneus sulphureus* Cuvier and Valenciennes, USNM 145207, 93 mm. in standard length, from a specimen captured at Pandanon Isl., Philippines; B, *U. moluccensis* (Bleeker), USNM 138629, 94 mm., from Balayan Bay, Luzon Isl.; C, *U. vittatus* (Forskål), USNM 106850, 147 mm., from Iloilo, Panay Isl., Philippines; D, *U. arge* Jordan and Evermann, USNM 115685, 213 mm., from Canton Isl., Phoenix Islands; E, *U. tragula* Richardson, USNM 145233, 105 mm., Luzon Isl., Philippines.



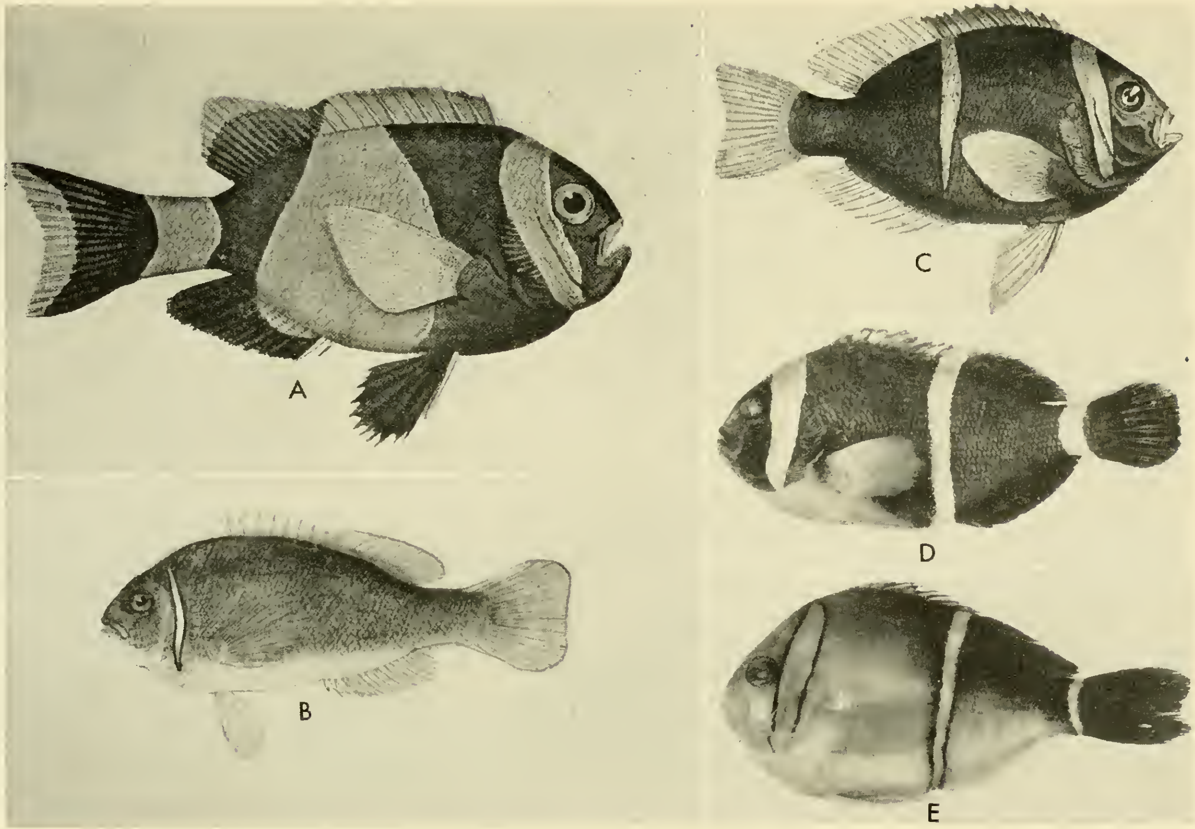
A, *Parupeneus indicus* (Shaw), USNM 145129, 188 mm. in standard length, from Luzon Isl., Philippines; B, *P. cyclostomus* (Lacepède), 194 mm., from the Marshall Islands; C, *P. luteus* (Cuvier and Valenciennes), USNM 138601, 148 mm., from Amboina, East Indies; D, *P. chrysonemus* (Jordan and Evermann), USNM 50676, paratype, 156 mm., from Hawaii; E, *P. crassilabris* (Cuvier and Valenciennes), 203 mm., from the Marshall Islands.



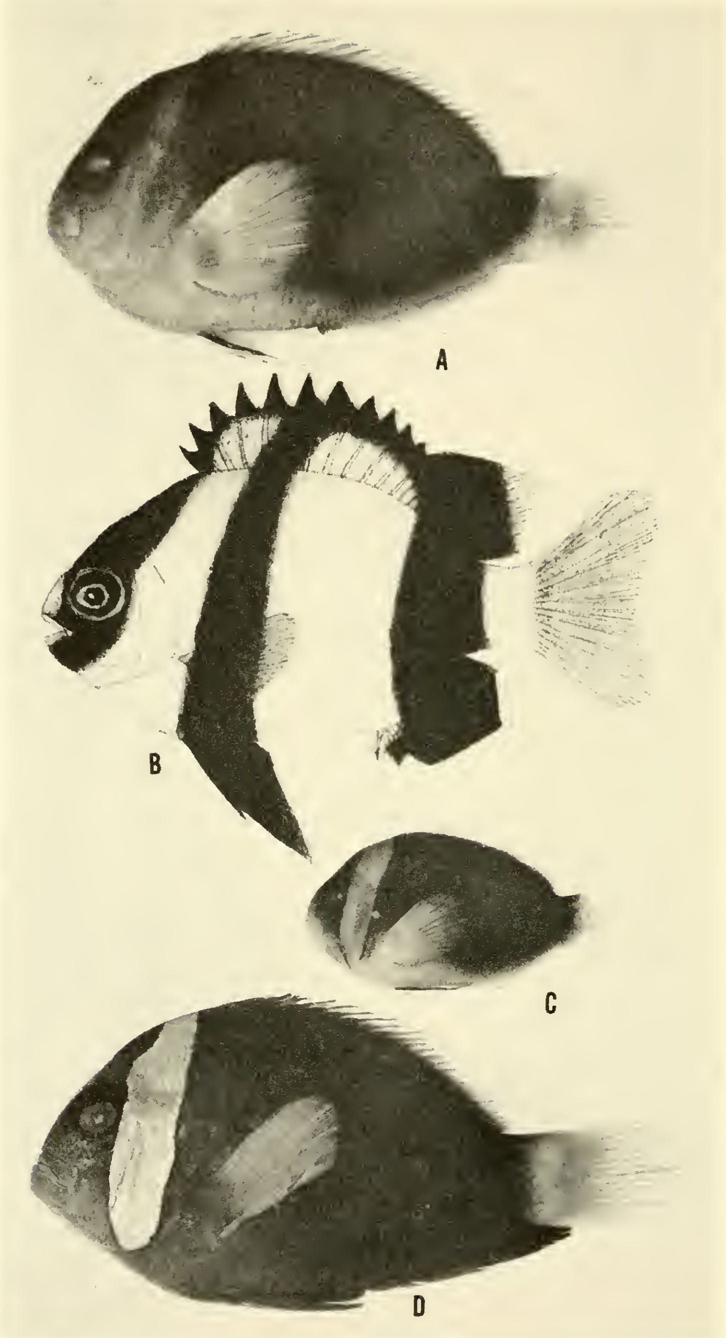
A, *Parupeneus bifasciatus* (Lacepède), USNM 145151, 117 mm., in standard length, from Mindanao Isl., Philippine Islands; B, *P. multifasciatus* (Quoy and Gaimard), USNM 157360, 198 mm., from Johnston Isl.; C, *P. trifasciatus* (Lacepède), 147 mm., from the Marshall Islands; D, *P. barberinoides* (Bleeker), USNM 138641, 152 mm., from Cebu market, Philippine Islands; E, *P. pleurostigma* (Bennett), 136 mm., from the Marshall Islands.



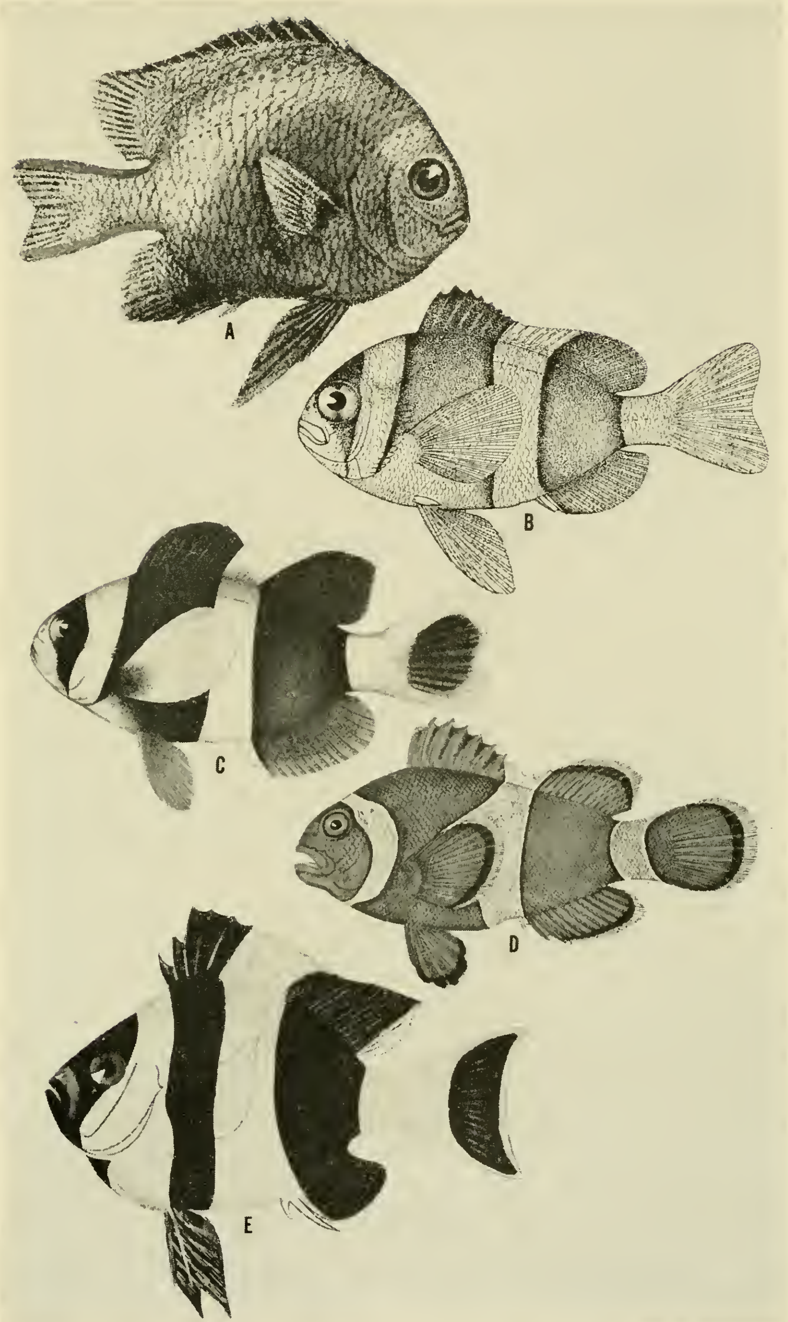
A, *Mulloidichthys samoensis* (Günther), 192 mm. in standard length, from the Marshal Islands; B, *M. auriflamma* (Forskål), USNM 115691, 150 mm., from the Samoan Islands; C, *M. pflugeri* (Steindachner), USNM 55516, 207 mm., from the Hawaiian Islands; D, *Parupeneus barberinus* (Lacepède), 154 mm., from the Marshall Islands; E, *P. orientalis* (Fowler), holotype, USNM 65639, 285 mm., from Easter Isl.



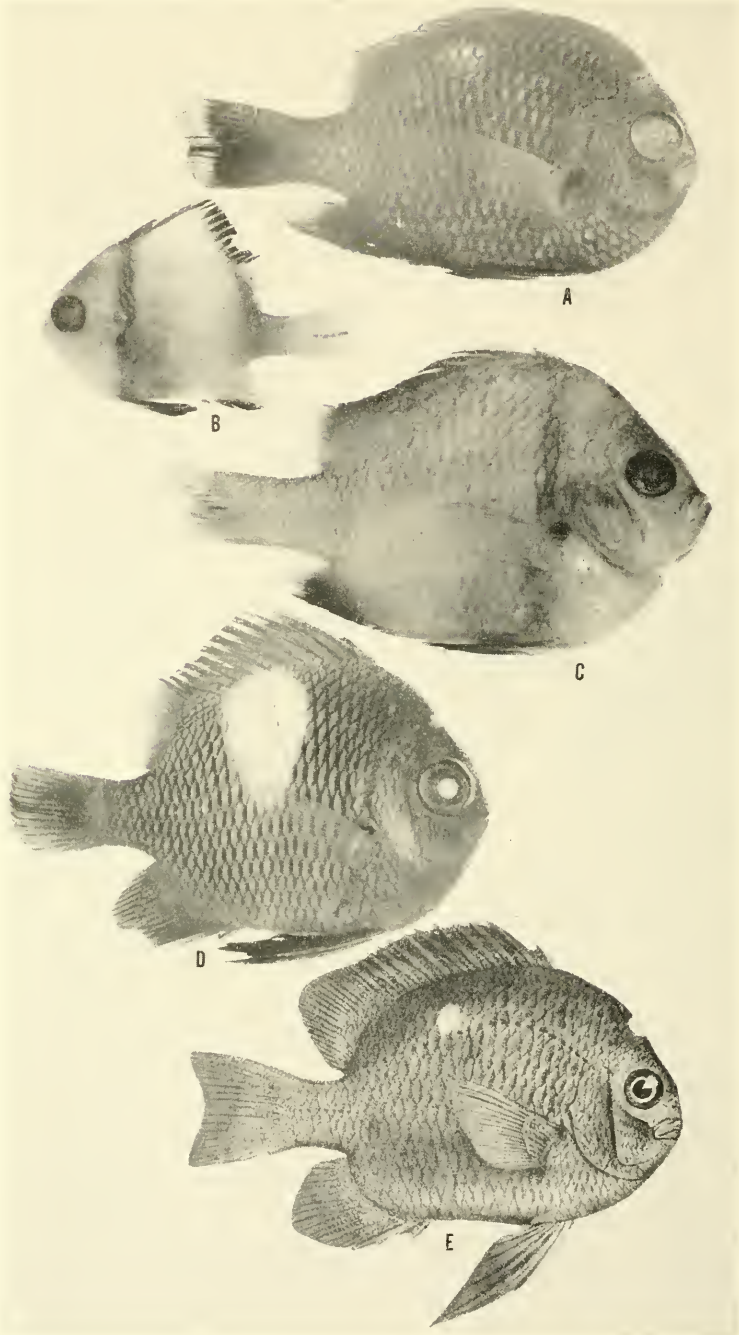
A, *Amphiprion latezonatus* Waite, after Waite; B, *A. perideraion* Bleeker, photograph of drawing in *Albatross* Philippine collection; C, *A. bicinctus* Rüppell, after Rüppell; D, *A. fusciventer* Bennett, MCZ 6093; E, *A. tricinctus* Schultz and Welander. USNM 152929, holotype.



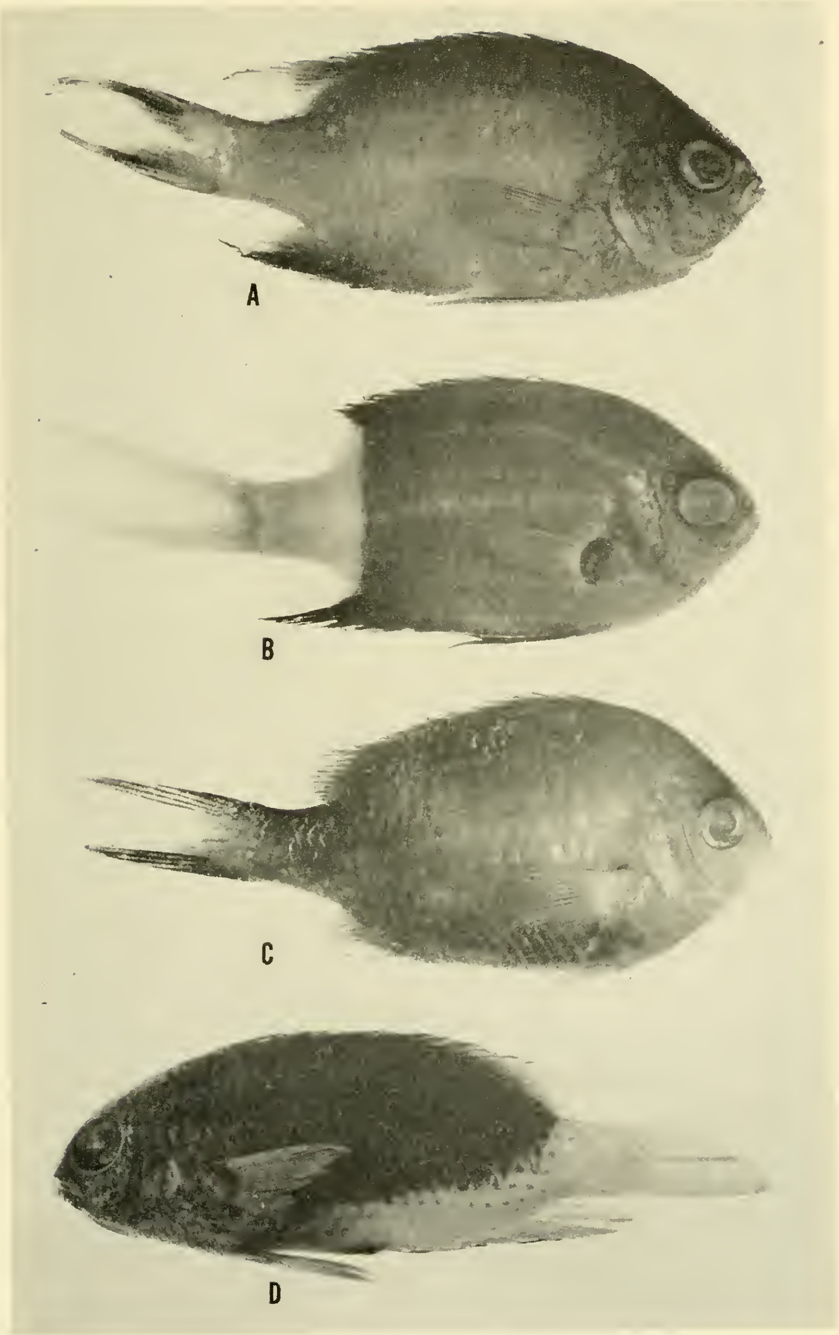
A, C, *Amphiprion ephippium* (Bloch), USNM 152777 from Darwin, Australia; B, *Dascyllus aruanus* (Linnaeus), photograph of watercolor sketch in *Albatross* Philippine collection. D, *Amphiprion melanopus* Bleeker, USNM 141026 from Bikini.



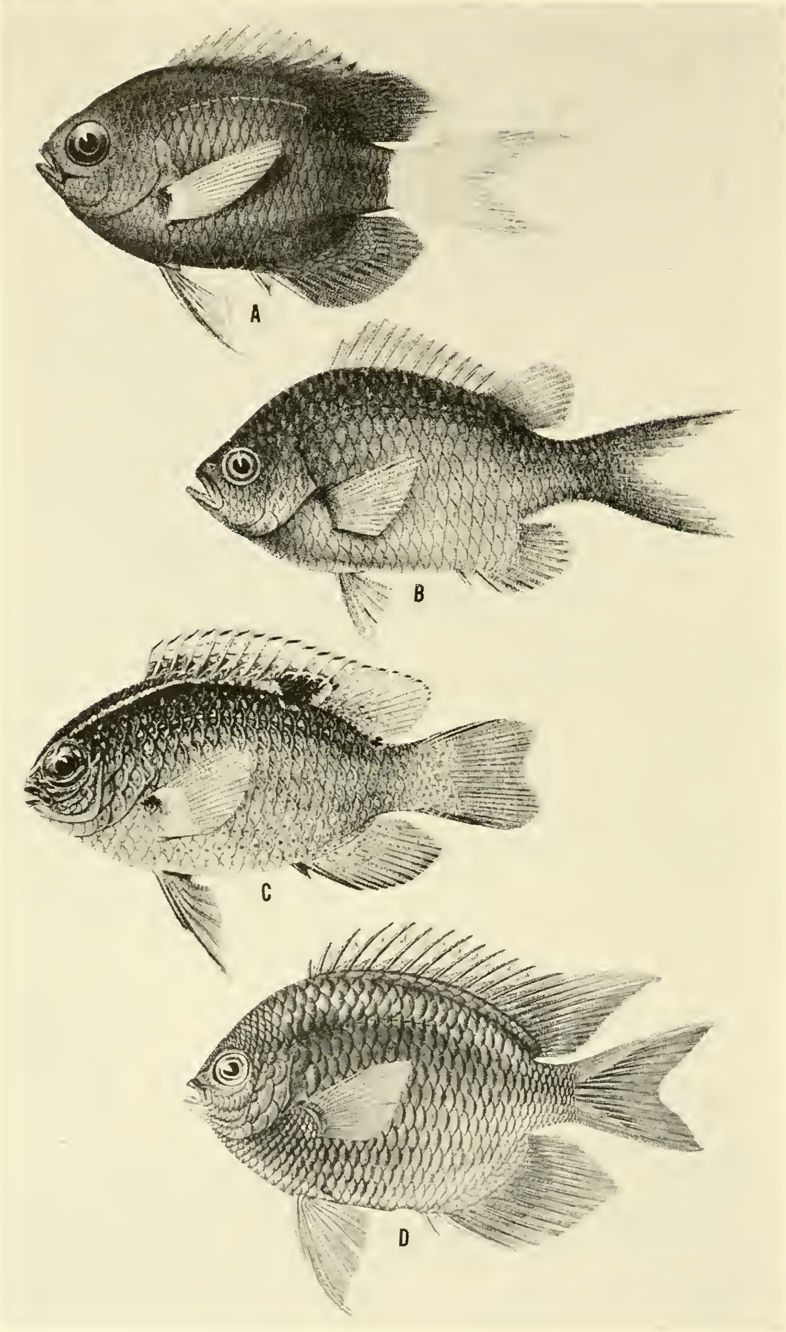
A, *Dascyllus marginatus* (Rüppell), after Rüppell; B, *Amphiprion sebae* Bleeker, after Okada and Ikeda; C, *A. chrysogaster* Cuvier and Valenciennes, after Okada and Ikeda; D, *A. percula* (Lacepède), photograph of color drawing in *Albatross* Philippine collection. E, *D. melanurus* Bleeker, photograph of watercolor sketch by Frederick M. Bayer.



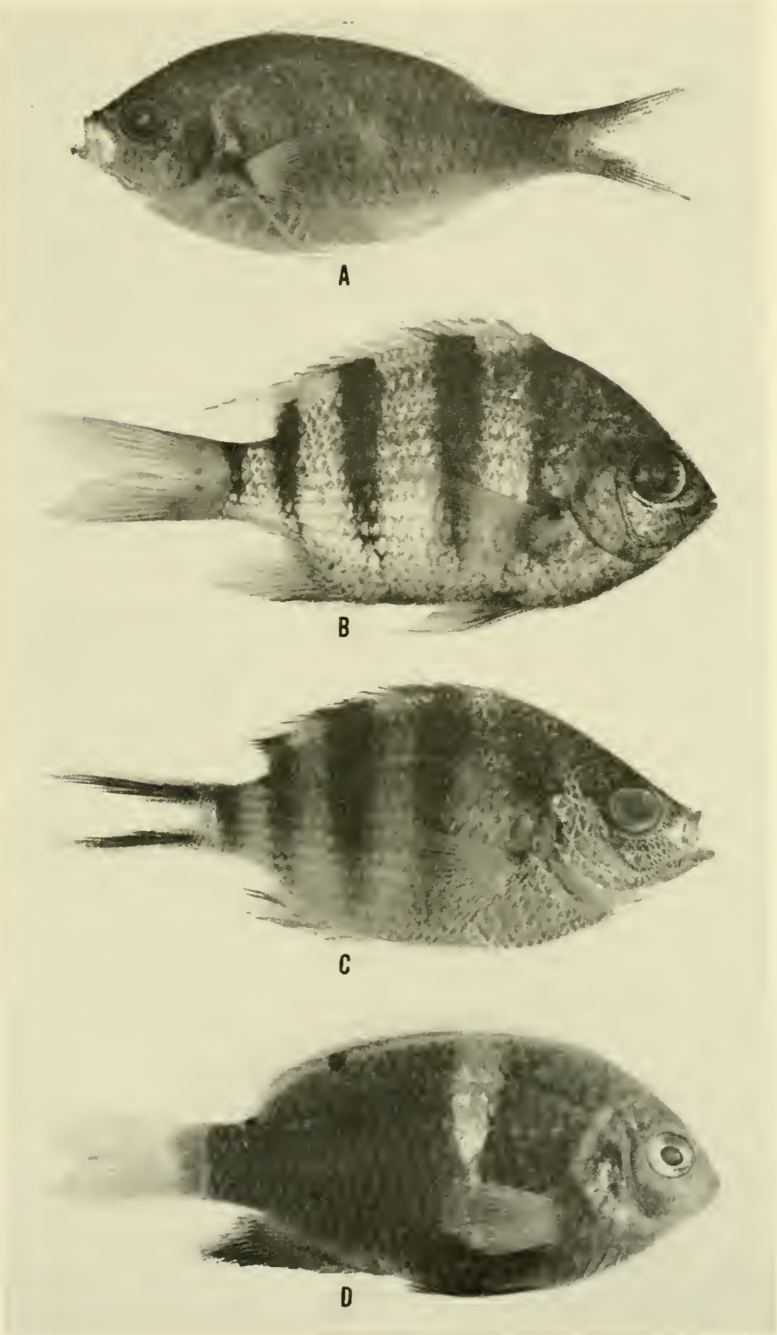
A, *Dascyllus trimaculatus* (Rüppell), USNM 166671, from Bikini; B, C, *D. reticulatus* (Richardson): B, young, USNM 166671, from Arno Atoll, C, adult, USNM 140933, from Bikini Atoll; D, *D. albisella* Gill, USNM 55322, from Honolulu; E, *D. trimaculatus* (Rüppell), after Rüppell, from Red Sea.



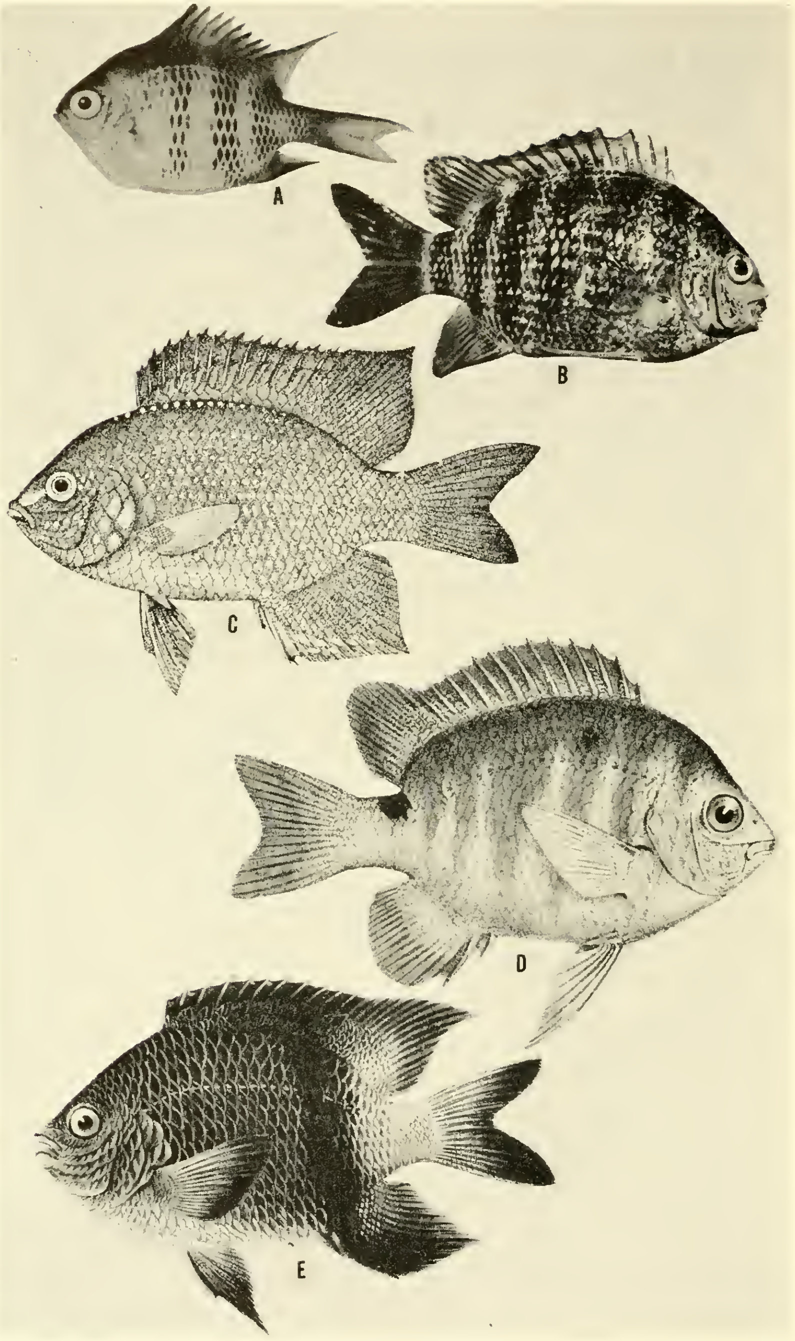
A, *Chromis lepidolepis* Bleeker, USNM 141025, from Bikini Atoll; B, *C. dimidiatus* (Klunzinger), USNM 167275, from Onotoa Atoll: C, *C. ternatensis* Bleeker, USNM 141047, from Bikini Atoll; D, *Pomacentrus coelestis* Jordan and Starks, USNM 152911, from northern Marshall Islands.



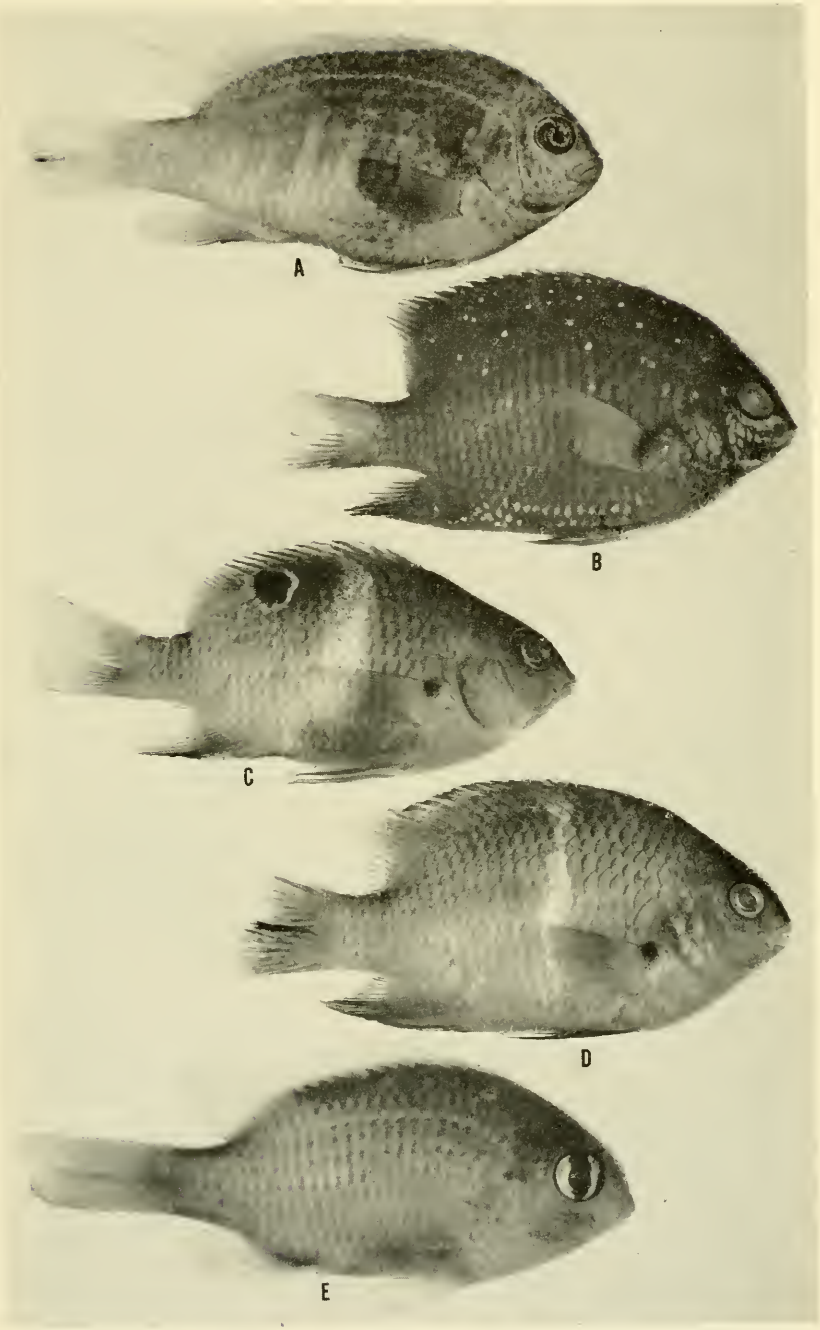
A, *Chromis leucurus* Gilbert, holotype, after Gilbert; B, *C. caeruleus* (Cuvier and Valenciennes), after Bleeker; C, *Abudefduf biocellatus* (Quoy and Gaimard), after Jordan and Seale; D, *A. aureus* (Cuvier and Valenciennes), photograph of color drawing in *Albatross* Philippine collection.



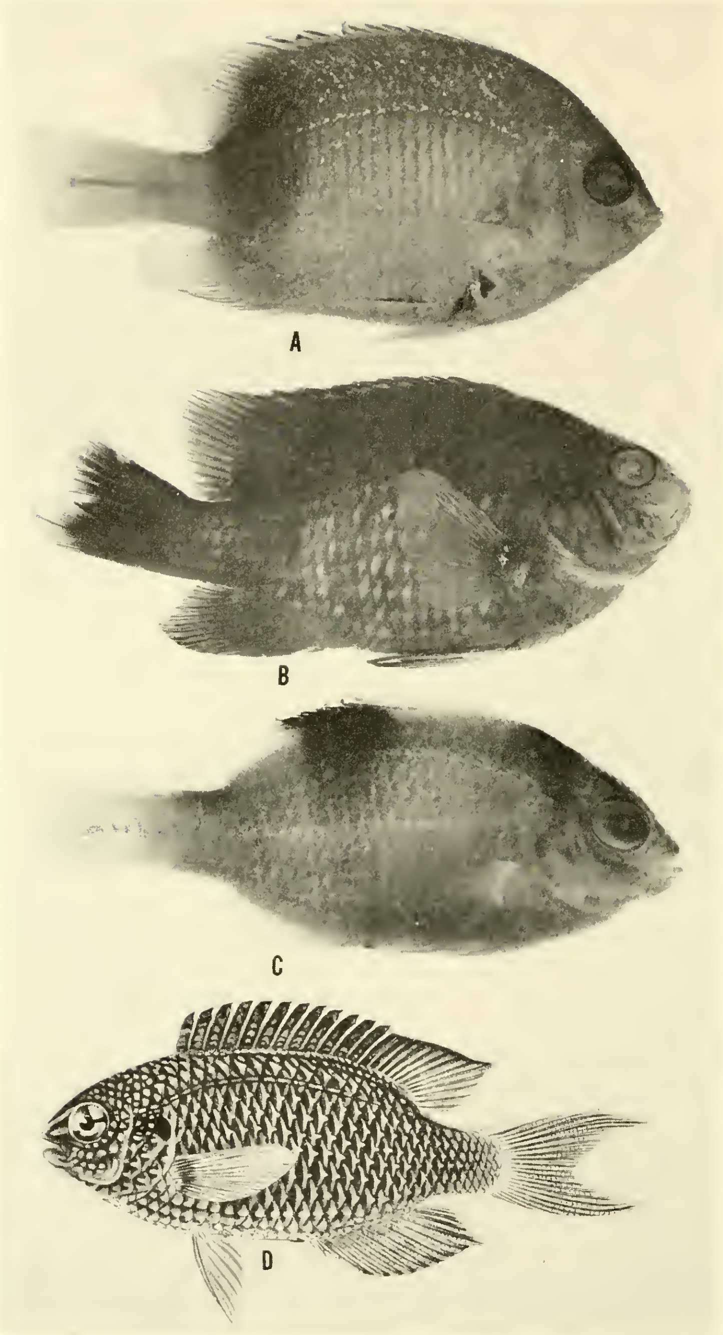
A, *Chromis atripectoralis* Welander and Schultz, holotype, USNM 112397; B, *Abudefduf saxatilis* (Linnaeus), USNM 143923, from Guam; C, *A. sexfasciatus* (Lacepède), USNM 143933, from Guam; D, *A. biocellatus* (Quoy and Gaimard), USNM 141089, from Bikini Atoll.



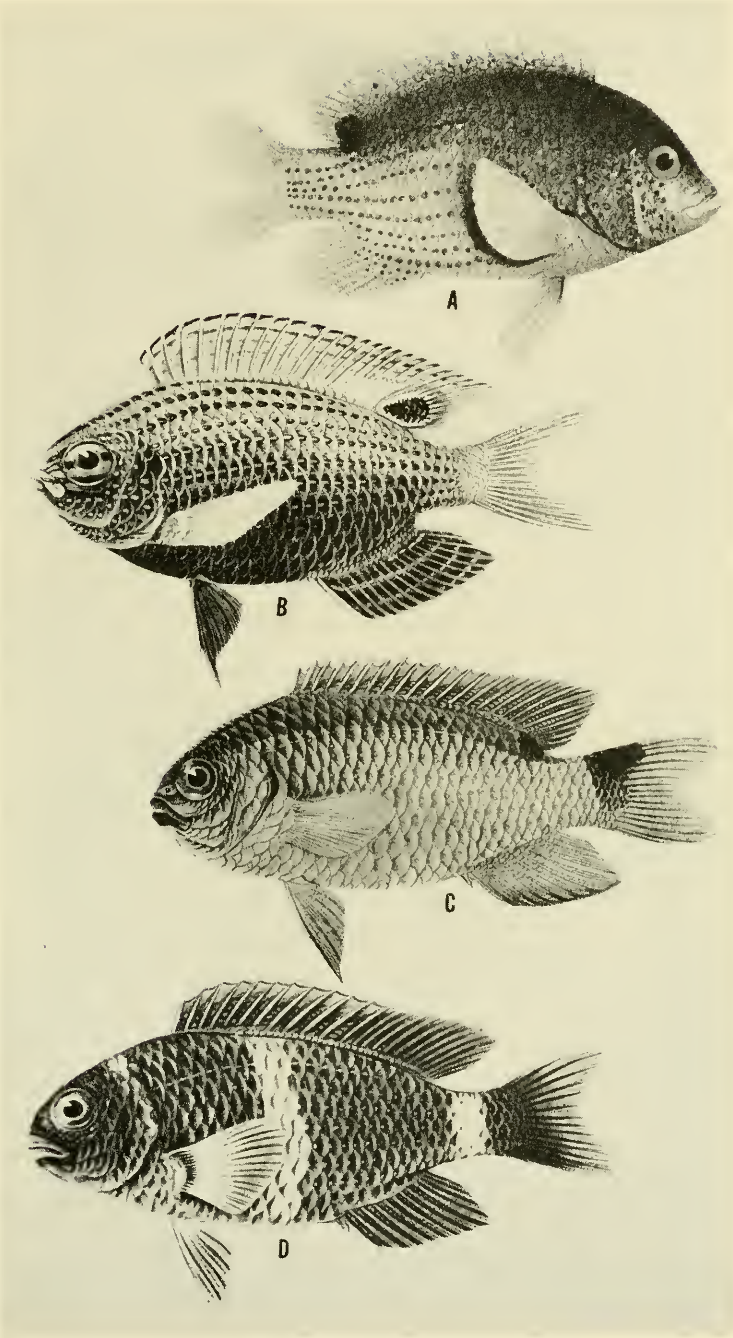
A, *Abudefduf curacao* (Bloch), photograph of a kodachrome taken at Bikini; B, *A. septemfasciatus* (Cuvier and Valenciennes), photograph of a kodachrome taken at Bikini; C, *A. johnstonianus* (Fowler and Ball), after Fowler and Ball; D, *A. sordidus* (Forskål), after Rüppell; E, *A. dicki* (Liènard), after Jordan and Seale.



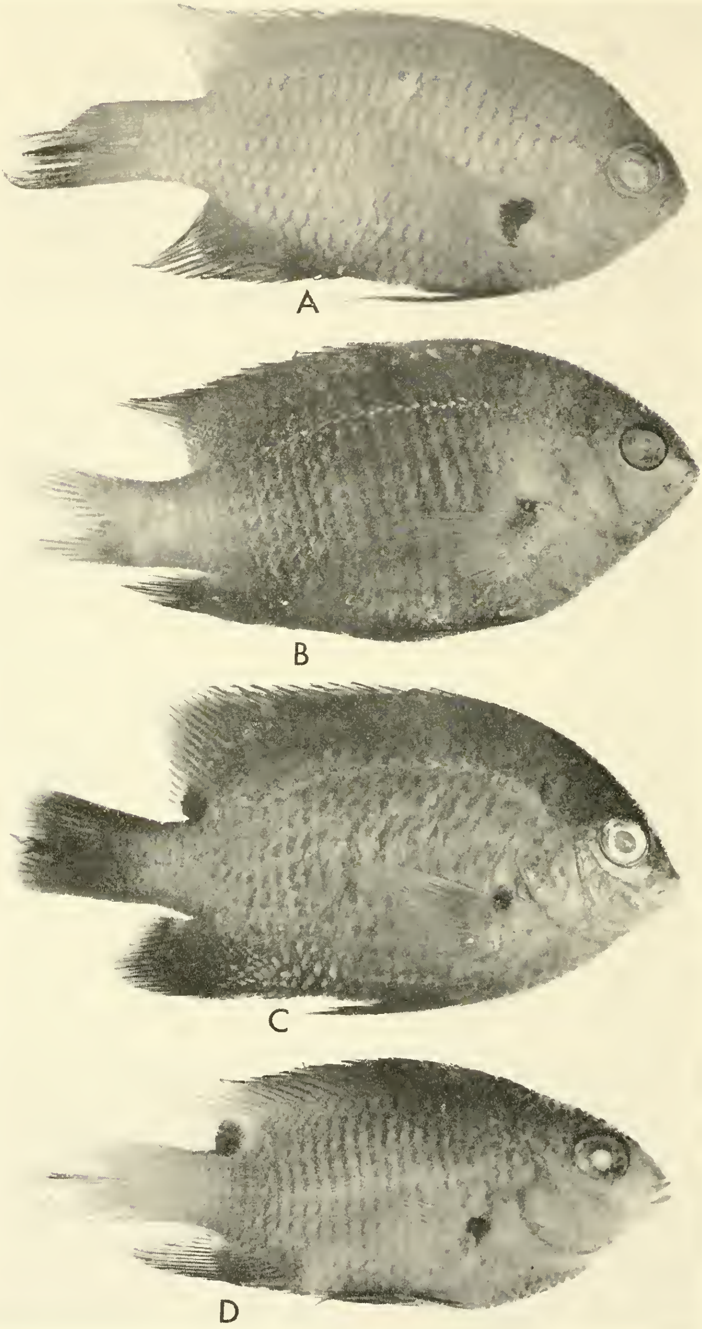
A, *Abudefduf glaucus* (Cuvier and Valenciennes), USNM 141100, from Bikini Atoll; B, *A. lacrymatus* (Quoy and Gaimard), USNM 141117, from Bikini Atoll; C, D, *A. leucozona* (Bleeker): C, young, USNM 141076, from Kwajalein Atoll, D, adult, USNM 139791, from Rota Isl.; E, *A. imparipennis* (Vaillant and Sauvage), USNM 115774, from Swains Isl.



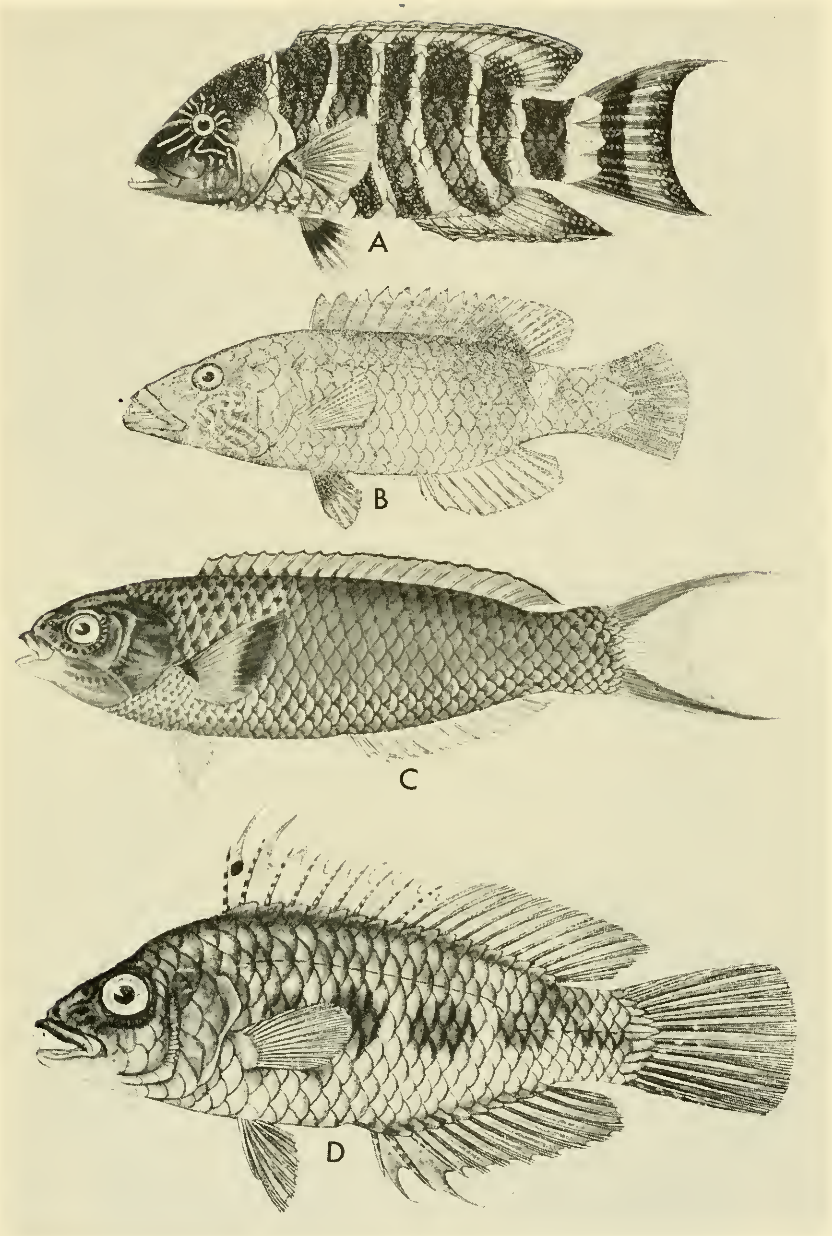
A, *Abudefduf johnstonianus* (Fowler and Ball), USNM 141058, from Rongelap Atoll; B, *Pomacentrus albofasciatus* Schlegel and Müller, adult, USNM 124006, from Guam; C, *P. bifasciatus* Bleeker, USNM 144098, from Guam; D, *P. pavo* (Bloch), after Jordan and Seale.



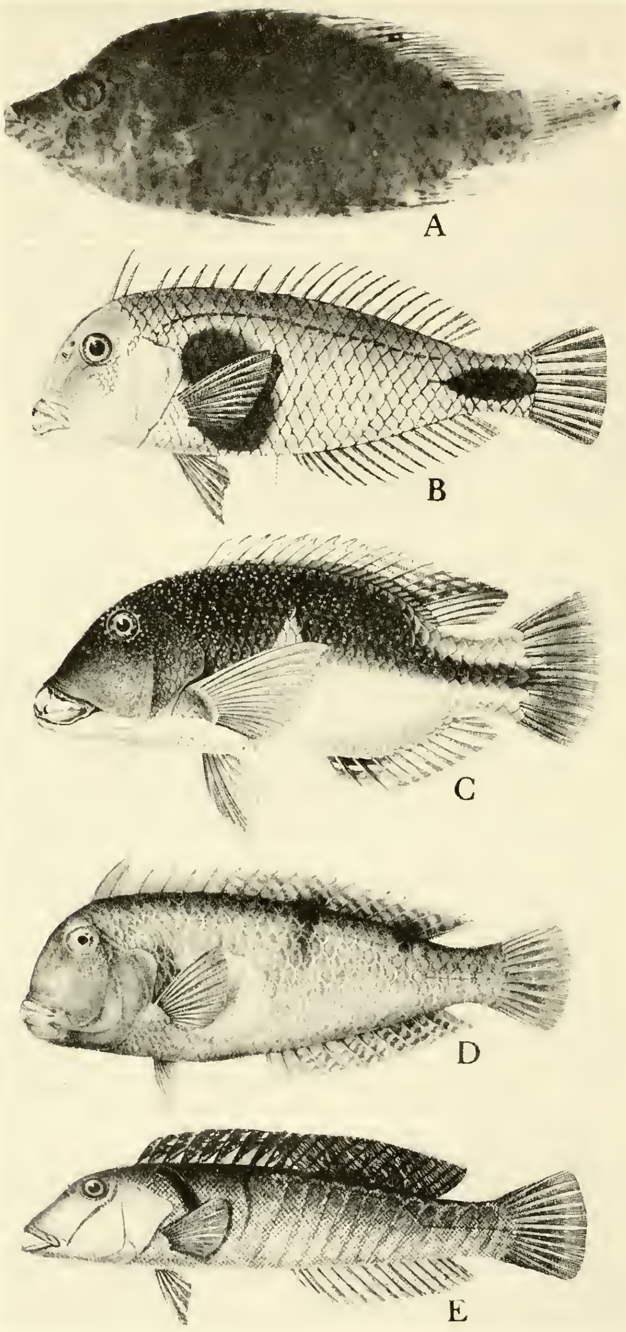
A, *Pomacentrus lividus* (Bloch and Schneider), after Günther; B, *P. vaiuli* Jordan and Seale, after Jordan and Seale; C, *Abudefduf leucopomus* (Lesson), after Jordan and Seale; D, *A. amabilis* (De Vis), after Jordan and Seale.



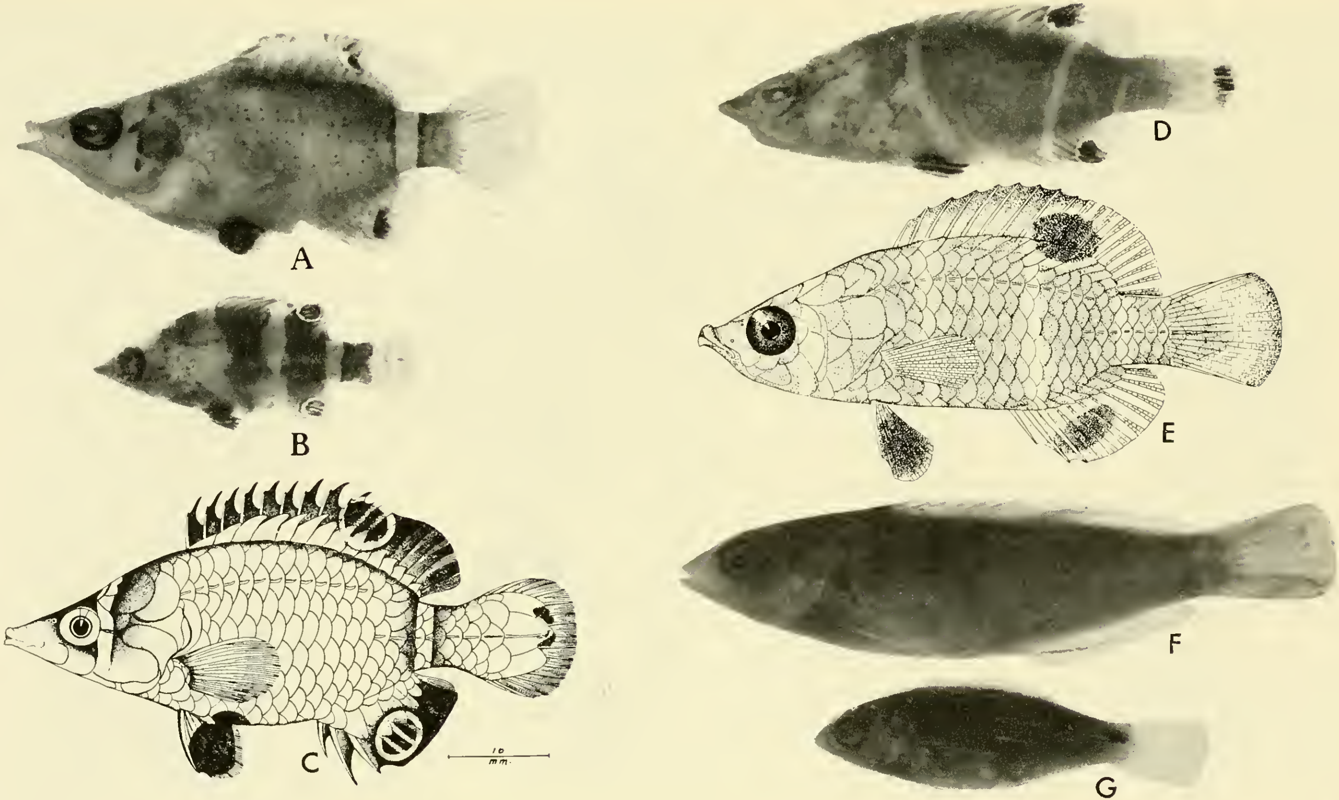
A, *Pomacentrus melanopterus* Bleeker, USNM 152290, from Tutuila Isl., Samoa; B, *P. jenkinsi* Jordan and Evermann, USNM 141319, from Bikini Atoll; C, *P. nigricans* (Lacepède), USNM 141369, from Rongerik Atoll; D, *P. albofasciatus* Schlegel and Muller, young, USNM 139776, from Rota Isl.



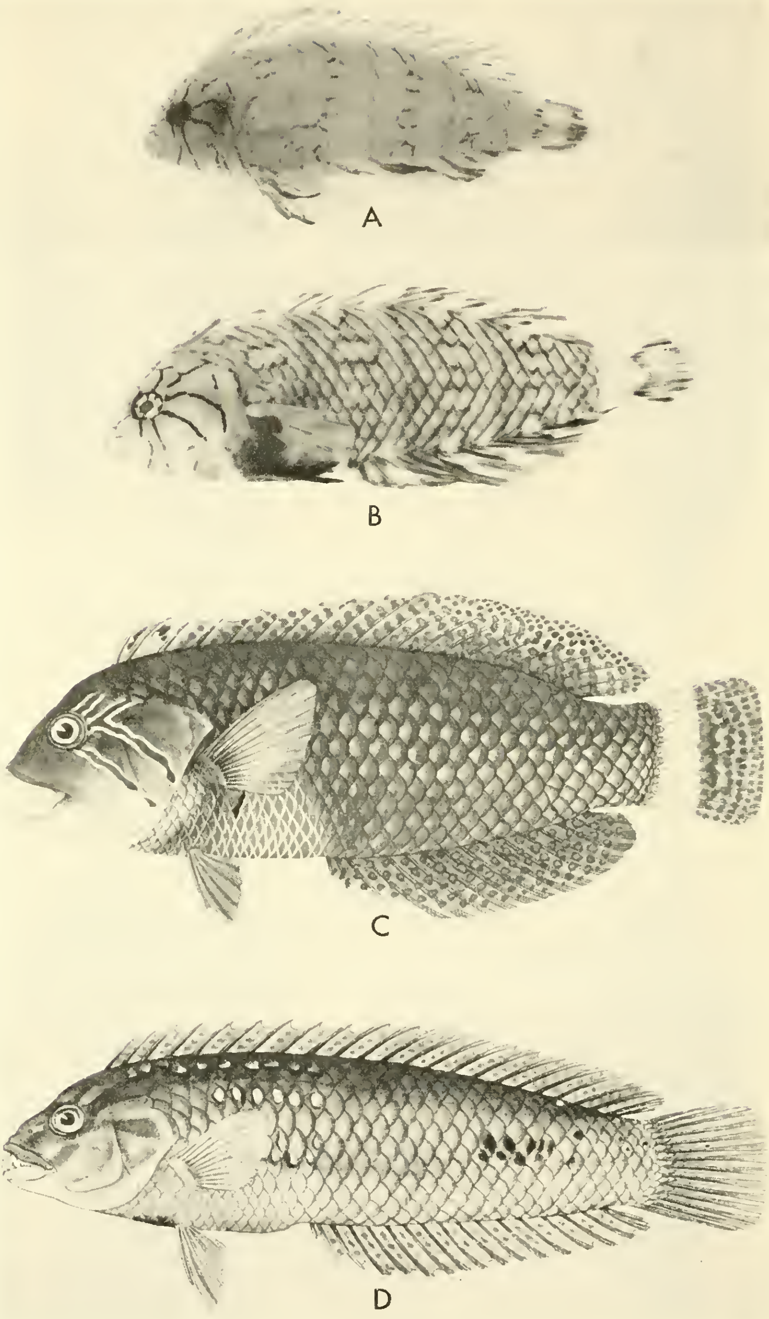
A, *Cheilinus fasciatus* (Bloch), after Bleeker; B, *C. rhodochrous* Günther, after Jenkins; C, *Thalassoma amblycephalus* (Bleeker), photograph of a color drawing (USNM 152688) in the *Albatross* Philippine collection; D, *Pteragogus flagellifera* (Cuvier and Valenciennes), photograph of a color drawing in the *Albatross* Philippine collection.



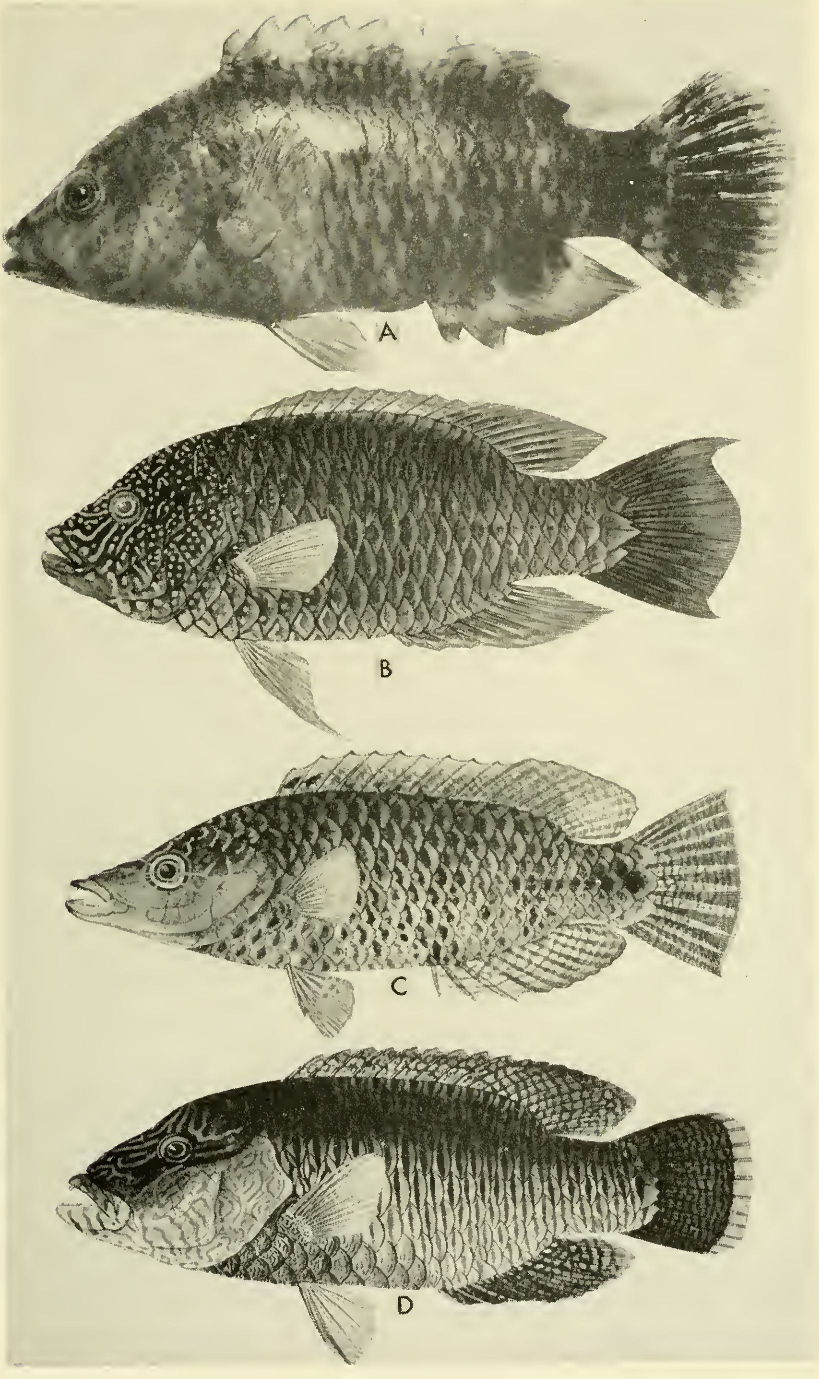
A, *Pteragogus guttatus* (Fowler and Bean), holotype, USNM 89969; B, *Hemipteronotus celebicus* (Bleeker), after Bleeker; C, *Choerodon anchorago* (Bloch), after Bleeker; D, *H. aneitensis* (Günther), after Günther; E, *Cymolutes praetextatus* (Quoy and Gaimard), after Bleeker.



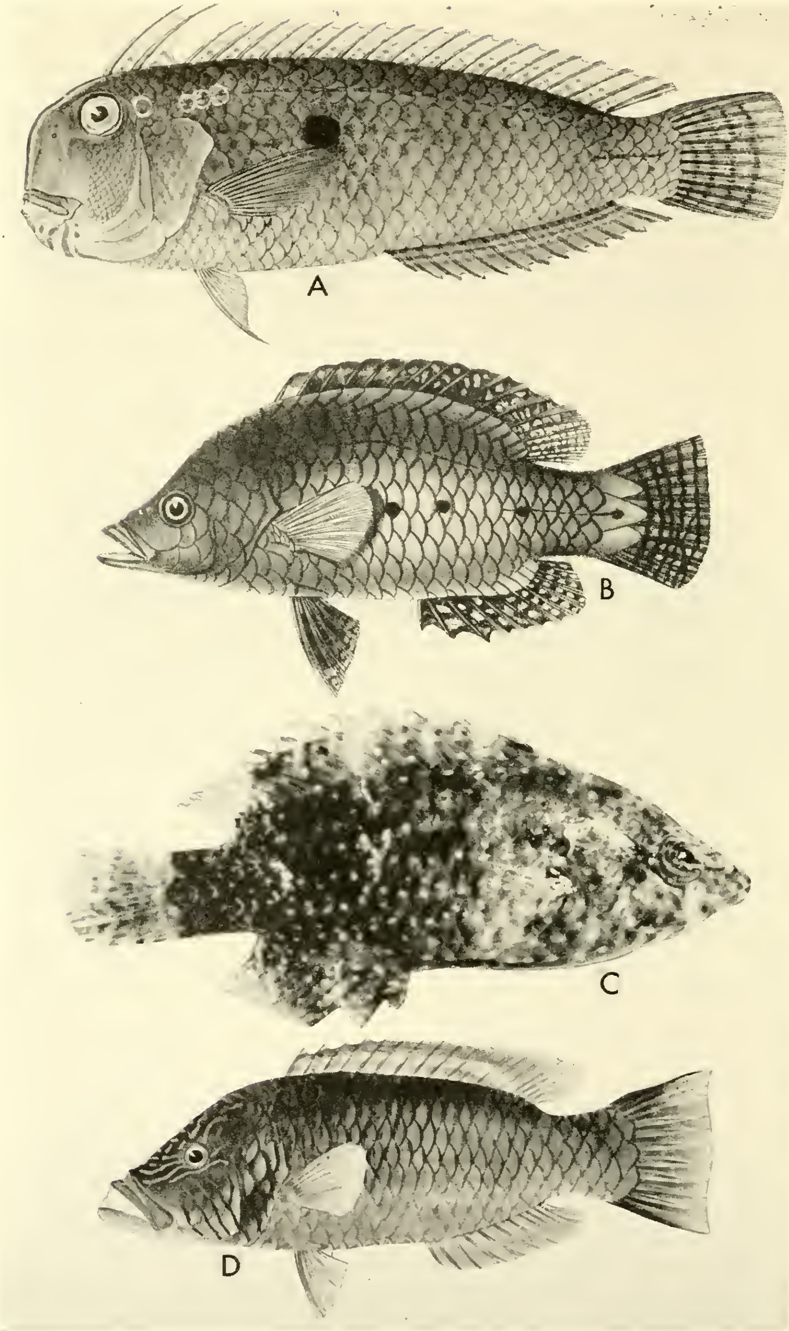
A, B, *Wetmorella ocellata* Schultz and Marshall: A, holotype, USNM 112368 B, paratype, USNM 112372, both from the Marshall Islands; C, *W. philippina philippina* Fowler, holotype, USNM 89968, from the Philippines; D, *W. albofasciata* Schultz and Marshall, holotype, USNM 93504, from the Philippines; E, *W. triocellata* Schultz and Marshall, holotype, USNM 93529, from the Philippines; F, G, *Cirrhilabrus temmincki* Bleeker, USNM 113623, from Rongelap Atoll.



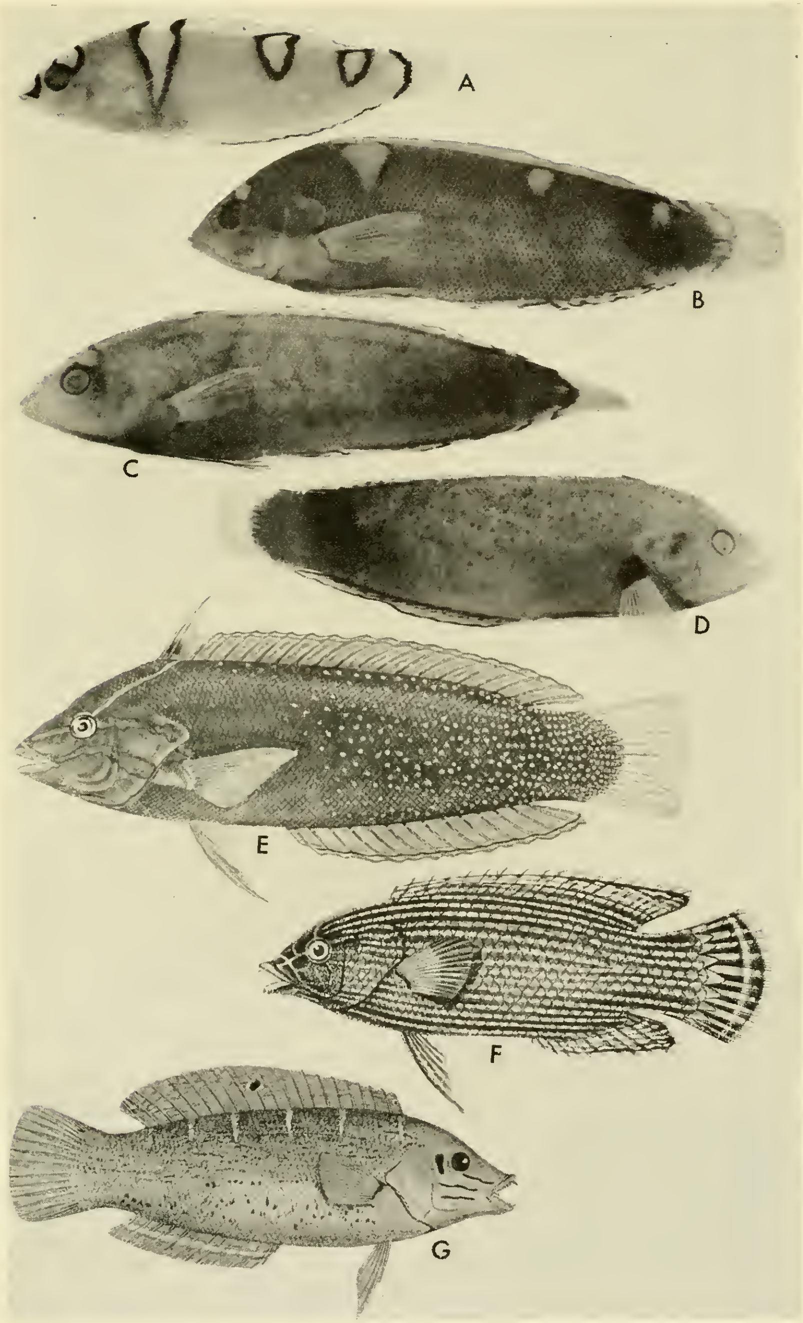
A, B, C, *Xyrichthys taeniourus* (Lacepède): A, specimen 43 mm. in standard length, B, 59 mm., both photographs of specimens taken at Bikini, C, adult; D, *X. macrolepidotus* (Bloch); C and D, photographs of color drawings in the *Albatross* Philippine collection.



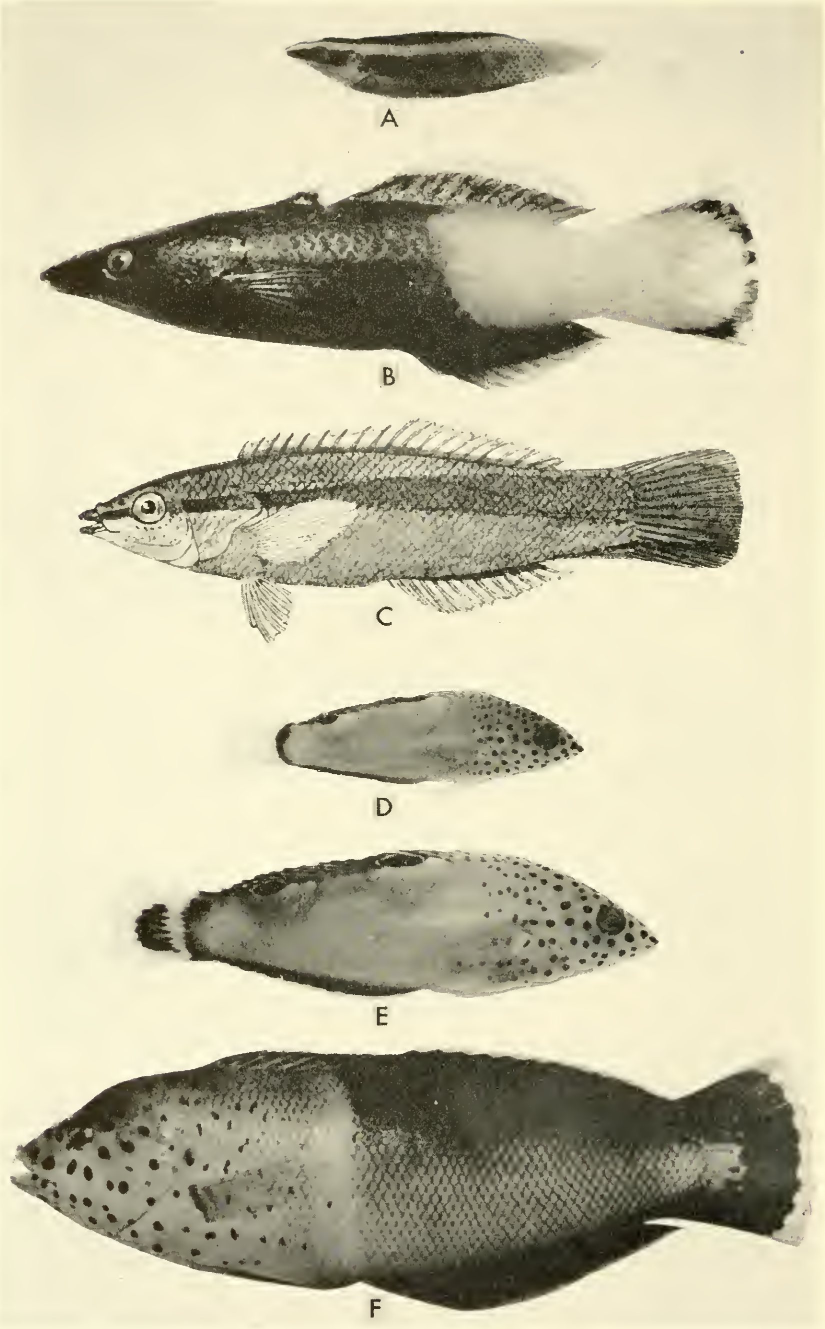
A, B, *Cheilinus trilobatus* Lacepède: A, immature from Bikini, B, adult; C, *C. celebicus* Bleeker; D, *C. undulatus* Rüppell; B, C, D, photographs of color drawings in the *Albatross* Philippine collection.



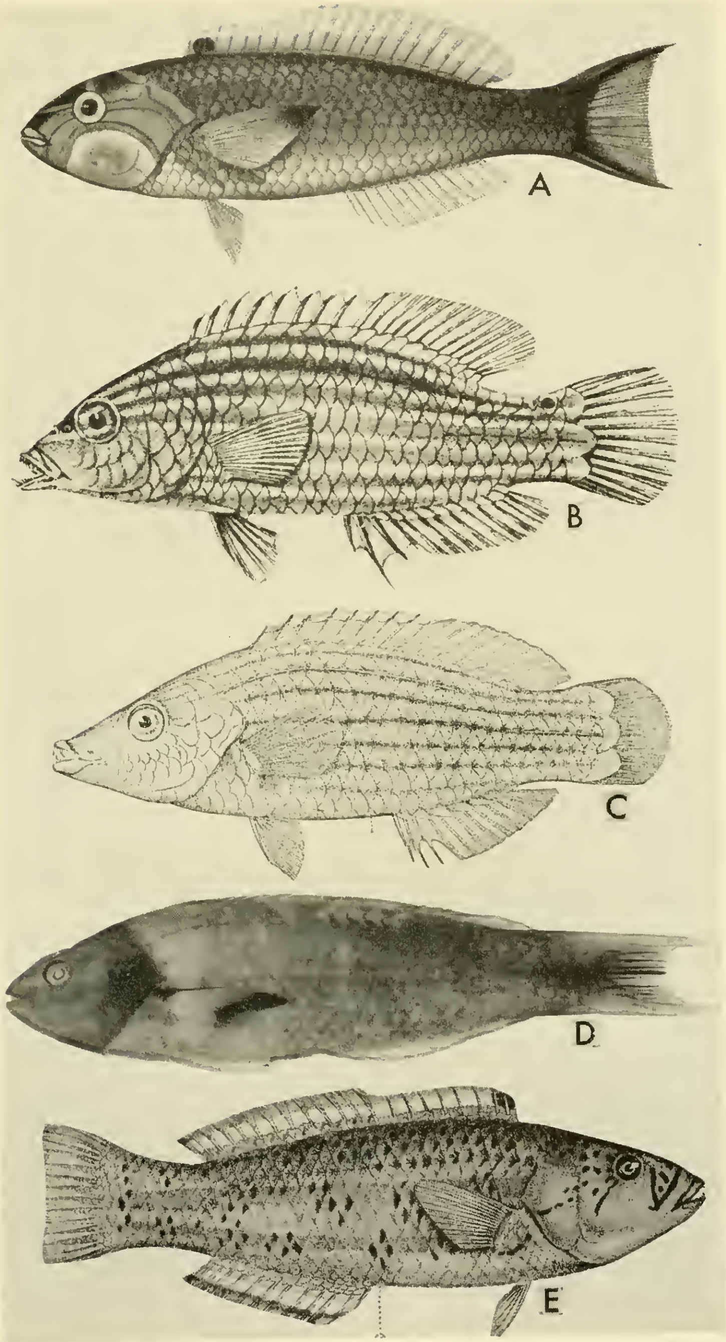
A, *Hemipteronotus pentadactylus* (Linnaeus), photograph of a color drawing in the *Albatross* Philippine collection; B, *Cheilinus oxycephalus* Bleeker, after Bleeker; C, *C. chlorourus* (Bloch), photograph of a kodachrome transparency taken at Bikini; D, *C. digrammus* (Lacepède), photograph of a color drawing in the *Albatross* Philippine collection.



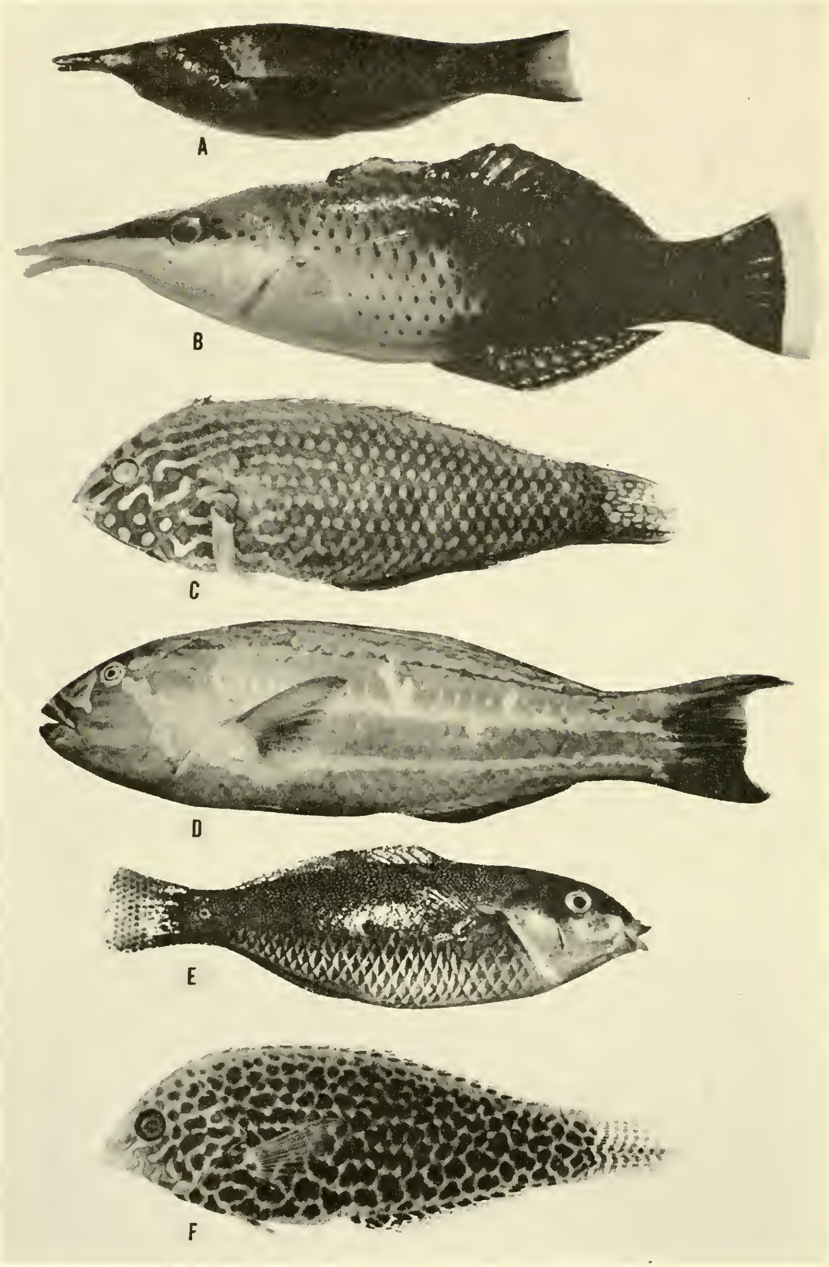
A–E, *Coris gaimardi* (Quoy and Gaimard): A, color pattern of specimens 13 to 36 mm. in standard length, B and C, 82 mm., D, 110 mm.; A–D, photographs of specimens from Bikini; E, adult, photograph of a color drawing in the *Albatross* Philippine collection; F, *Labrichthys cyanotaenia* Bleeker, after Bleeker; G, *Coris variegata* (Rüppell), after Rüppell.



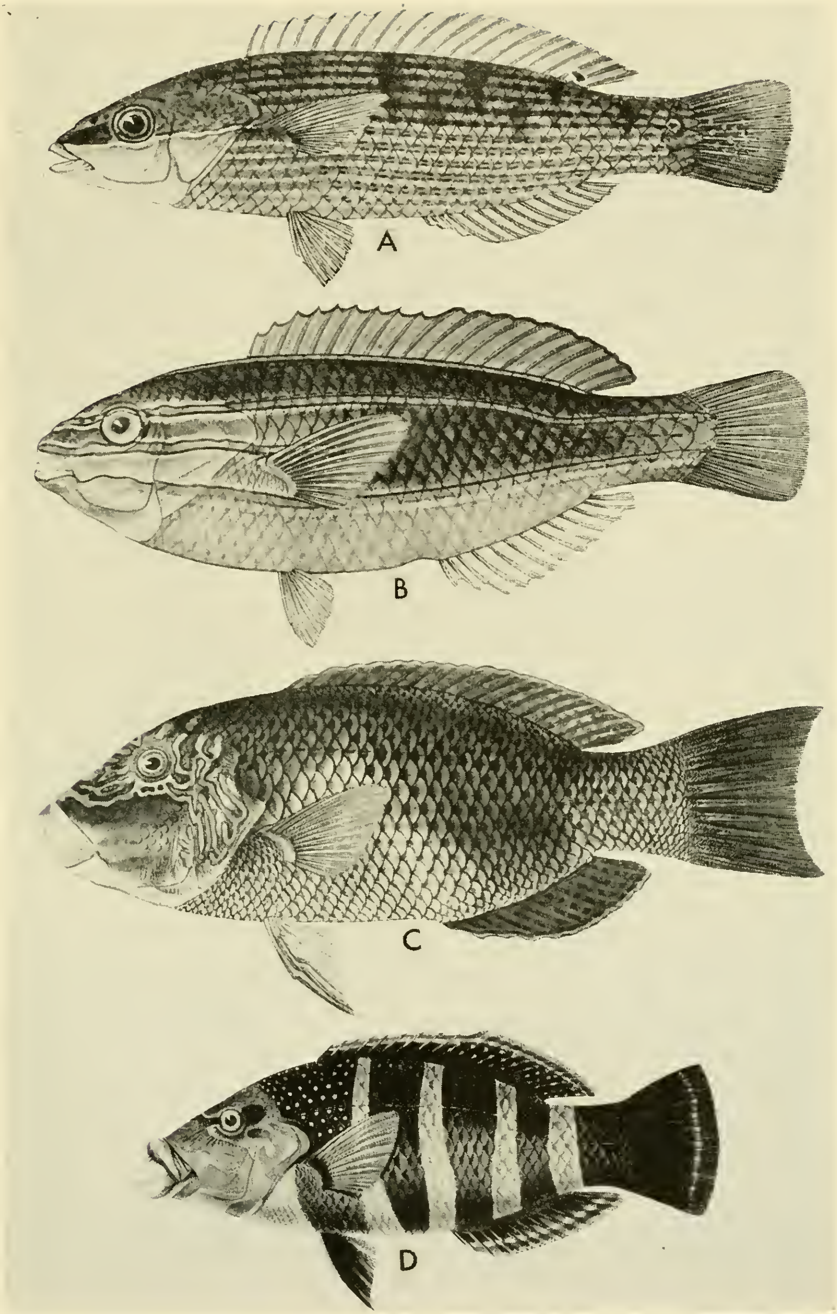
A and B, *Labroides bicolor* Fowler and Bean: A, young 33.5 mm. in standard length, B adult; C, *Labroides dimidiatus* (Cuvier and Valenciennes), photograph of a color sketch in the *Albatross* Philippine collection; D, E, F, *Coris aygula* Lacepède: D, 39 mm., E, 60 mm., F, young adult; A, B, D, E, F, photographs of Bikini specimens.



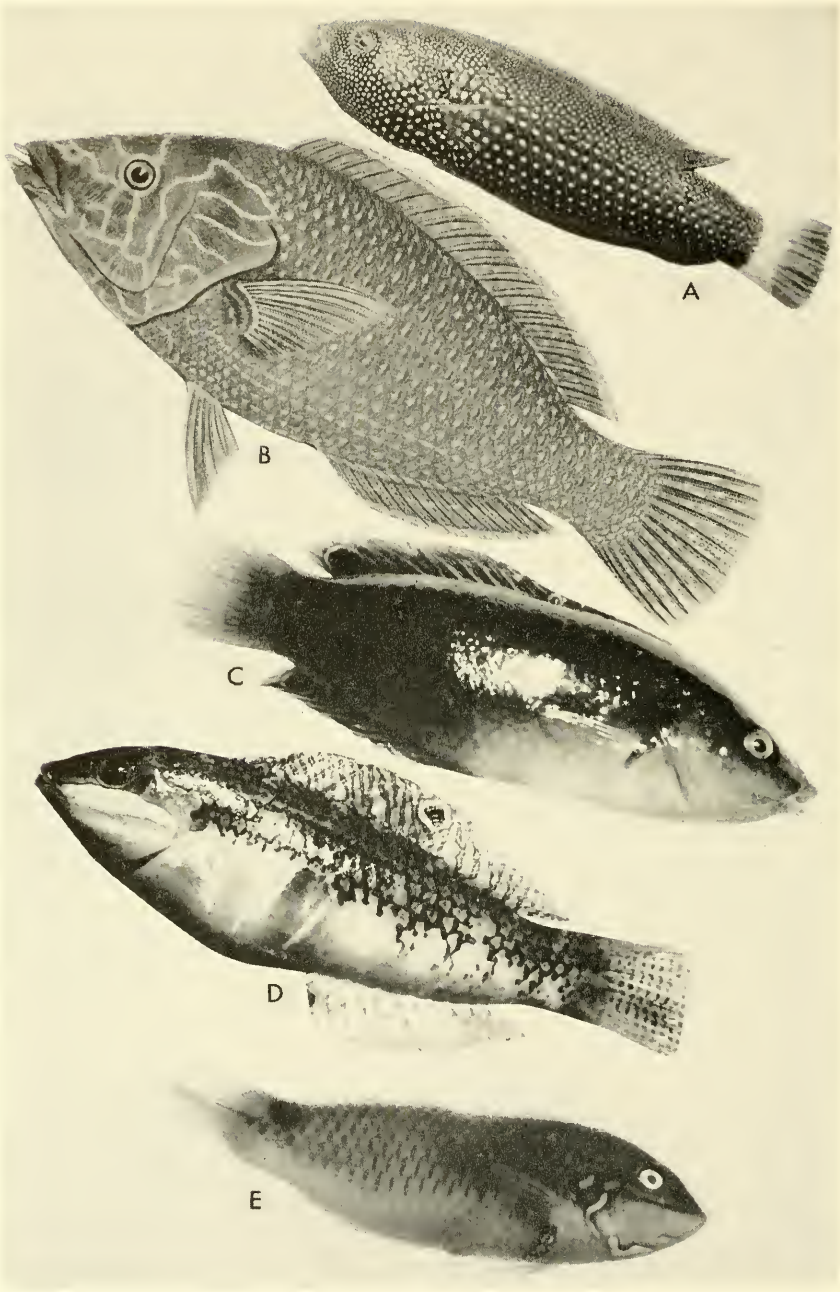
A, *Thalassoma quinquevittata* (Lay and Bennett), after Günther; B, *Pseudocheilinus hexataenia* (Bleeker), after Bleeker; C, *P. octotaenia* Jenkins, after Jenkins; D, *T. lucasanum* (Gill), USNM 65673, from Taboguilla Isl., Panama Bay; E, *T. umbrostygma* (Rüppell), after Rüppell.



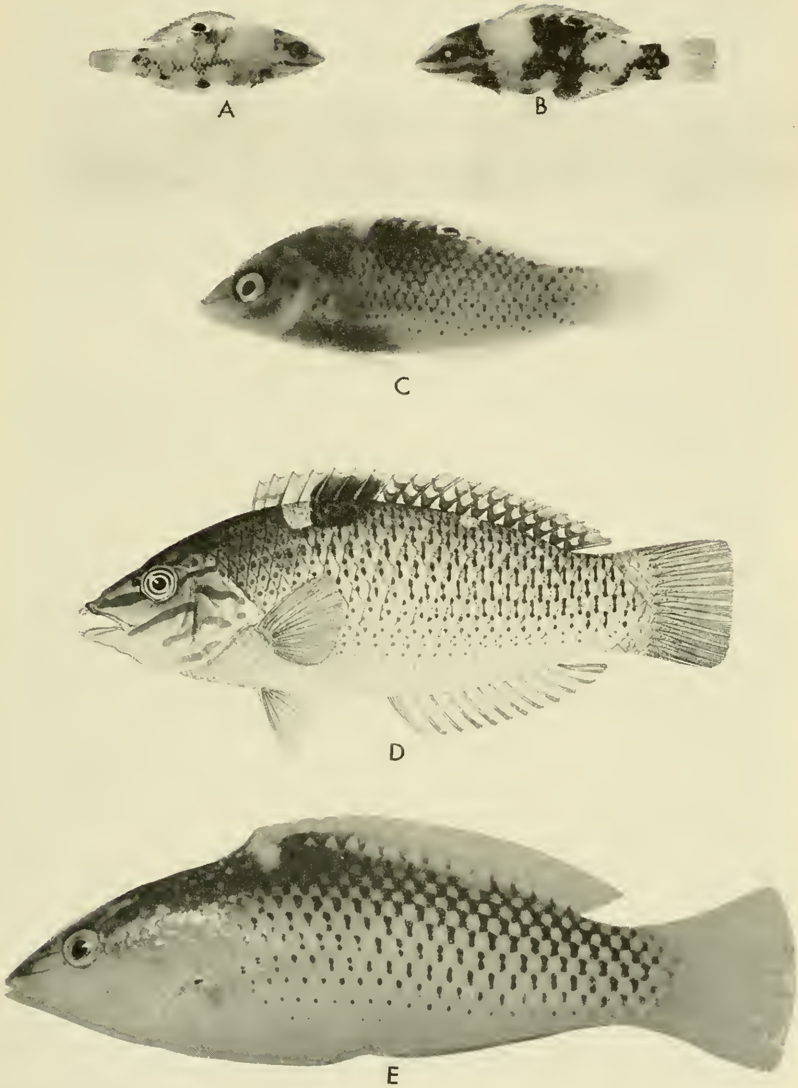
A, *Gomphosus tricolor* Quoy and Gaimard; B, *G. varius* Lacepède; C, *Macropharyngodon meleagris* (Cuvier and Valenciennes), USNM 113333, from Bikini Atoll; D, *Thalassoma purpureum* (Forskål); E, *Stethojulis axillaris* (Quoy and Gaimard); F, *M. paradalis* (Kner), USNM 115609, from Tutuila Isl.; A–E, photographs of Marshall Islands specimens.



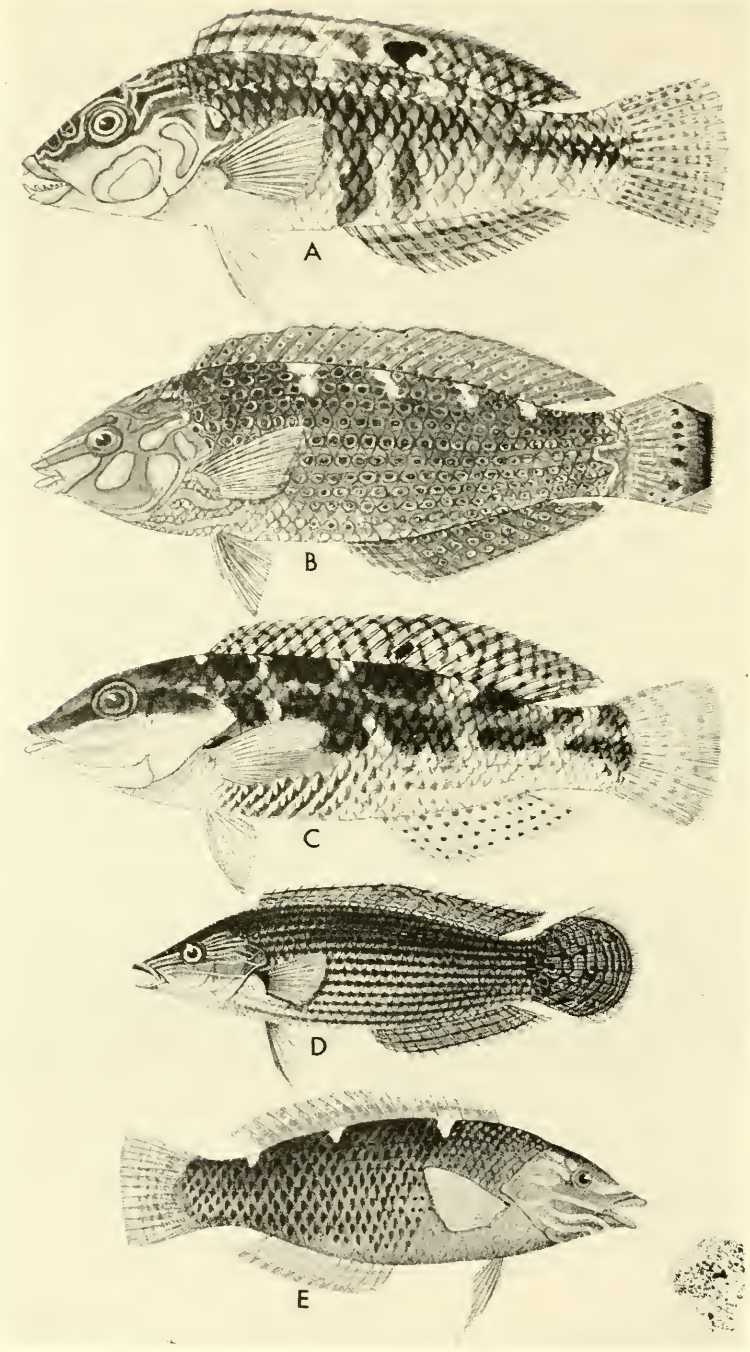
A, *Stethojulis strigiventer* (Bennett); B, *S. trilineatus* (Bloch and Schneider); C, *Hemigymnus melapterus* (Bloch); D, *H. fasciatus* (Bloch), after Bleeker; A, B, and C, photographs of color drawings in the *Albatross* Philippine collection.



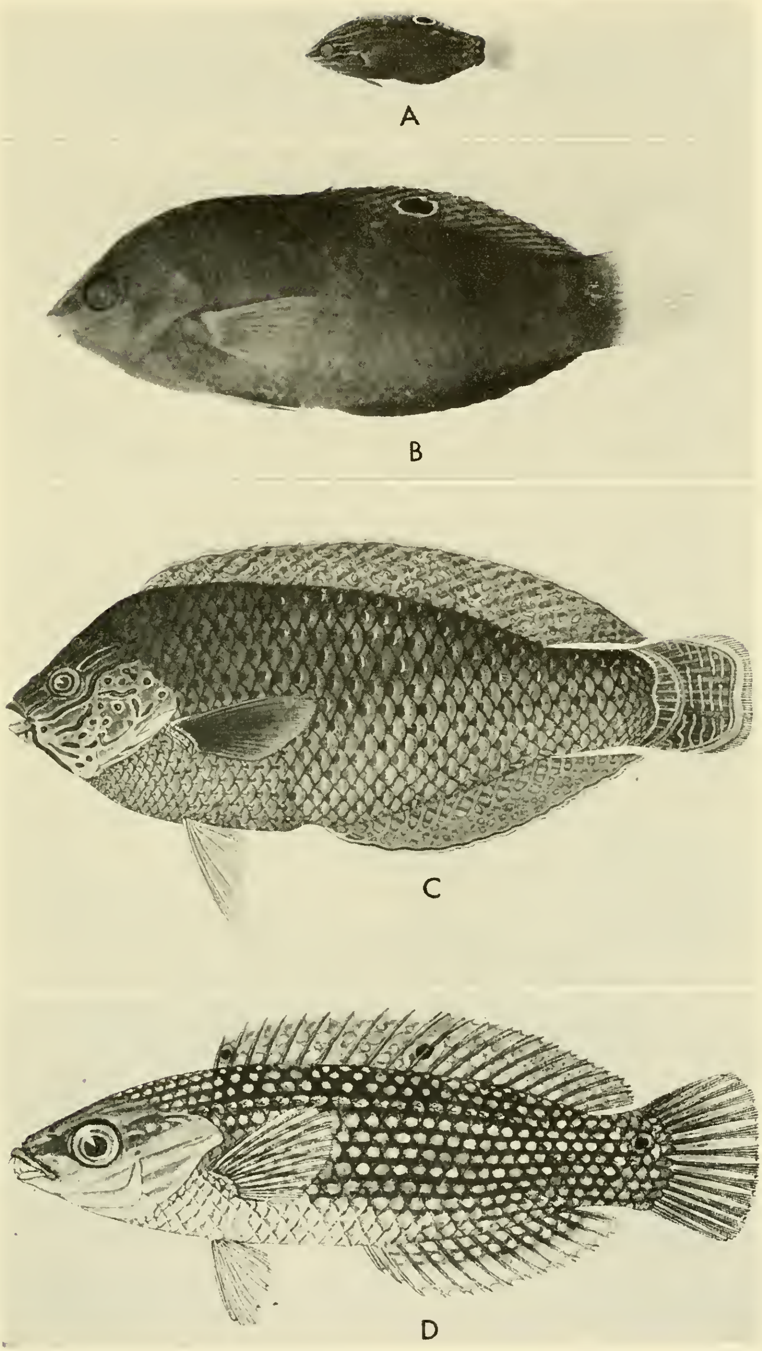
A, *Anampses rubrocaudata* Randall, photograph of a Hawaiian specimen by Spencer Tinker; B, *A. caeruleopunctatus* Rüppell, from Wilkes Exploring Expedition; C, *A. twisti* Bleeker; D, *Halichoeres margaritaceus* (Cuvier and Valenciennes); E. *H. trimaculatus* (Quoy and Gaimard); C, D, and E, photographs of specimens from Bikini.



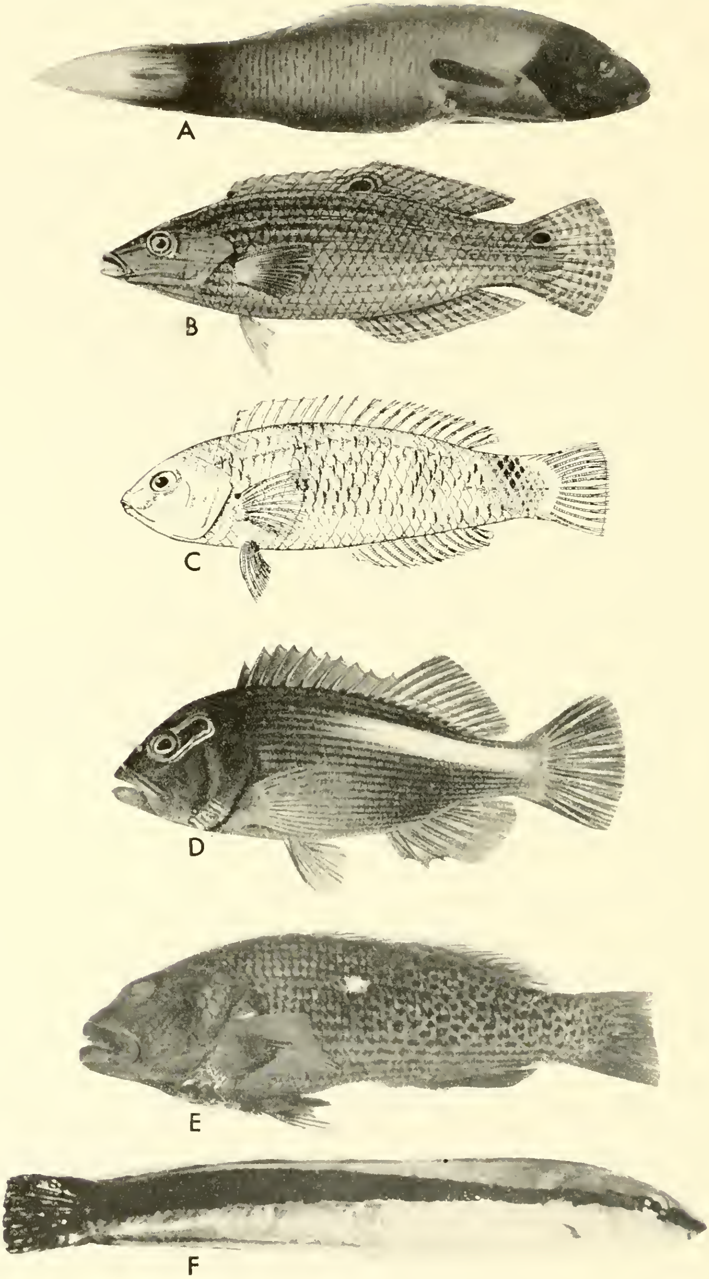
A to E, *Halichoeres hortulanus* (Lacepède), A, 26.5 mm., B, 34 mm., C, 56 mm., D, adult, E, adult; A, B, C, and E, photographs of specimens from Bikini; D, photograph of a color drawing in the *Albatross* Philippine collection.



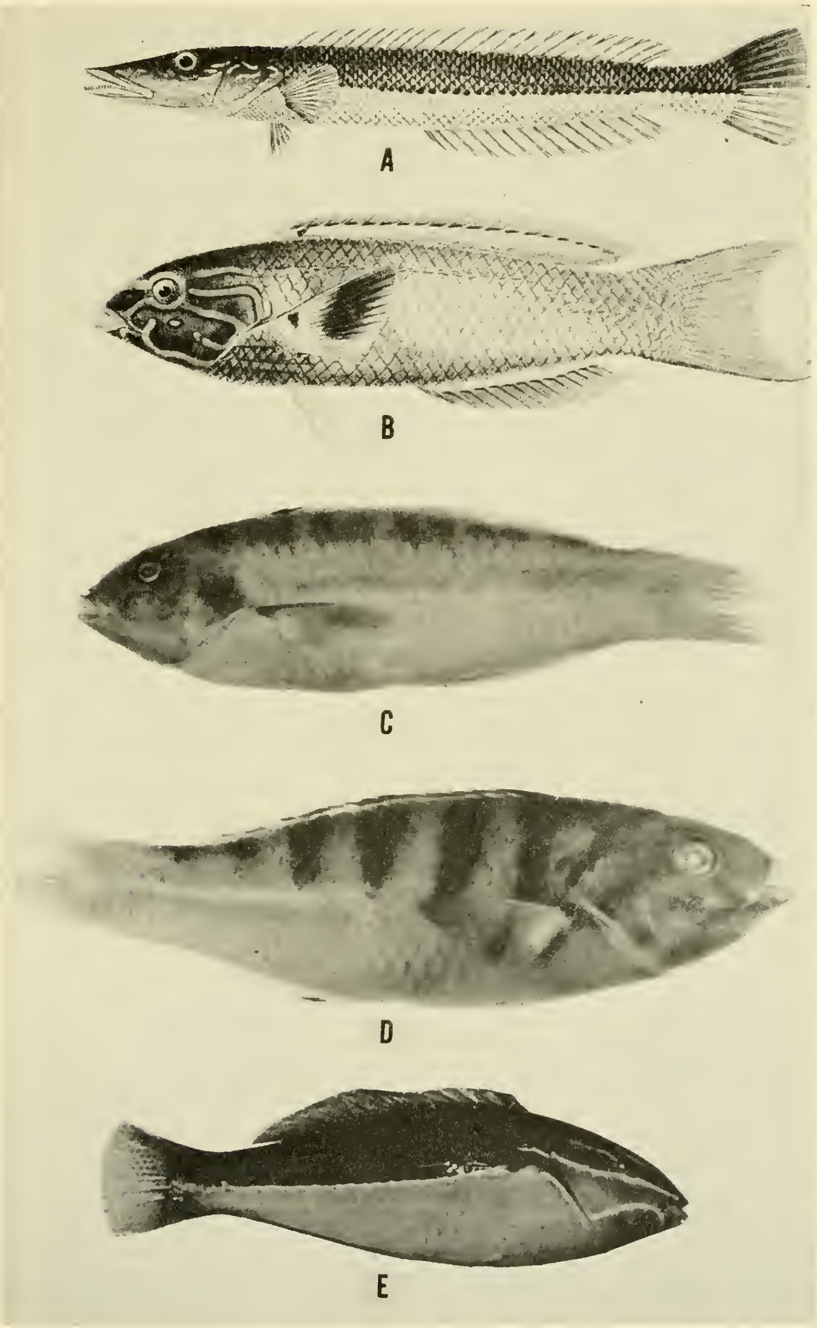
A, *Halichoeres nebulosus* (Cuvier and Valenciennes); B, *H. argus* (Bloch and Schneider); C, *H. miniatus* (Cuvier and Valenciennes); D, *H. kallochroma* (Bleeker), after Bleeker; E, *H. centriquadrus* (Lacepède), after Rüppell; A, B, C, photographs of color drawings in the *Albatross* Philippine collection.



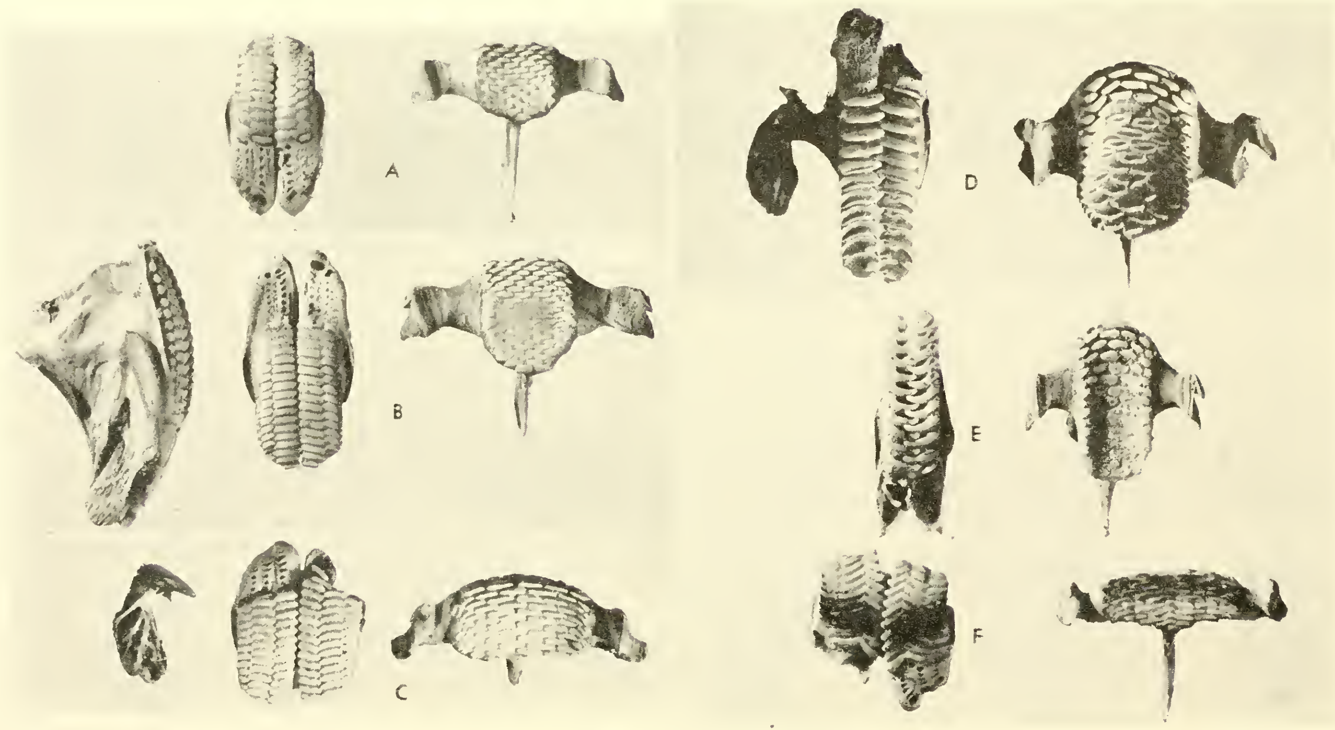
A, B, C, *Halichoeres marginatus* Rüppell: A, 37 mm., B, 69 mm., C, adult; A and B photographs of Bikini specimens; D, *H. leparensis* (Bleeker); C, D, photographs of color drawings in *Albatross* Philippine collection.



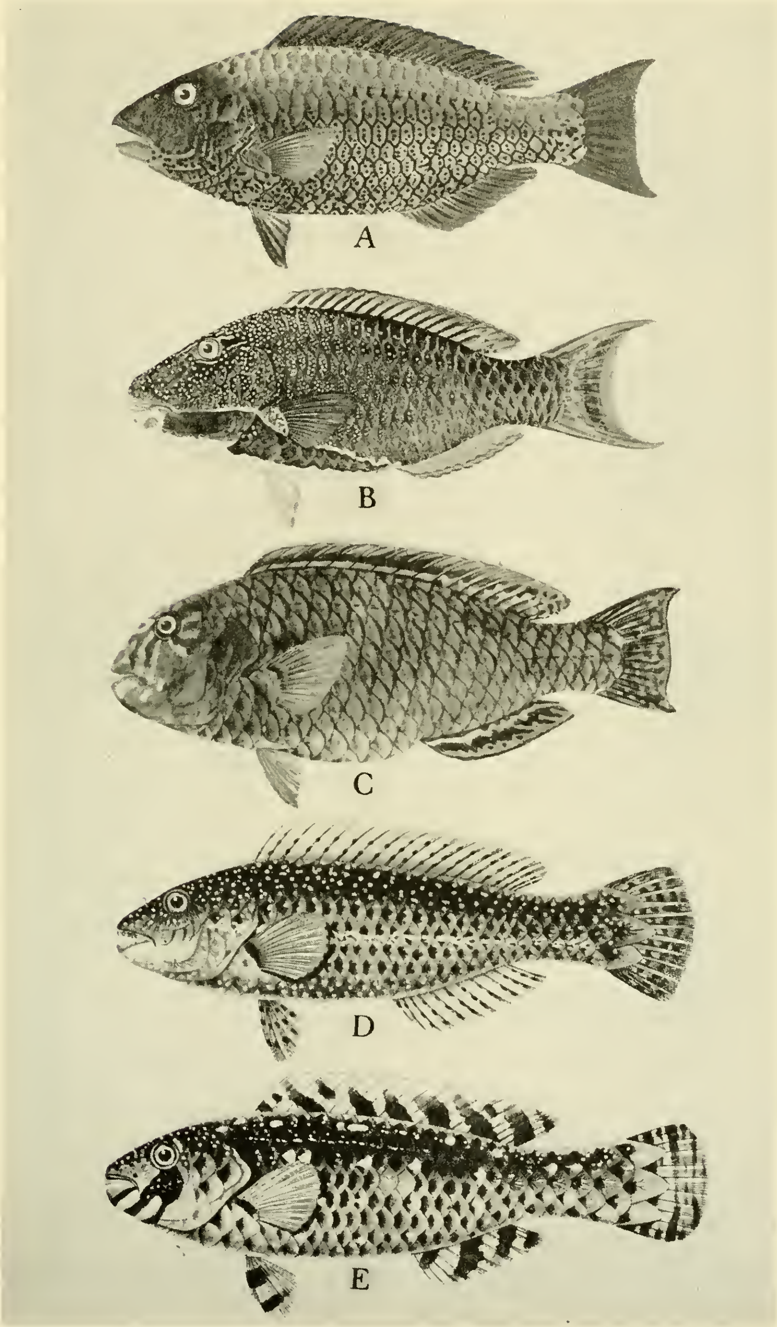
A, *Thalassoma lunare* (Linnaeus), USNM 167370 from Onotoa Atoll; B, *Halichoeres hoeveni* (Bleeker), after Bleeker; C, *H. trimaculatus* (Quoy and Gaimard), USNM 154281 from Angaur Isl., Carolines, drawn by Patricia J. Isham; D, *Gymnocirrhites arcatus* (Cuvier and Valenciennes), after Jordan and Evermann; E, *Paracirrhites hemistictus* (Günther), male, USNM 167404, from Onotoa Atoll; F, *Aspidontus taeniatus* Quoy and Gaimard, from kodachrome taken at Bikini.



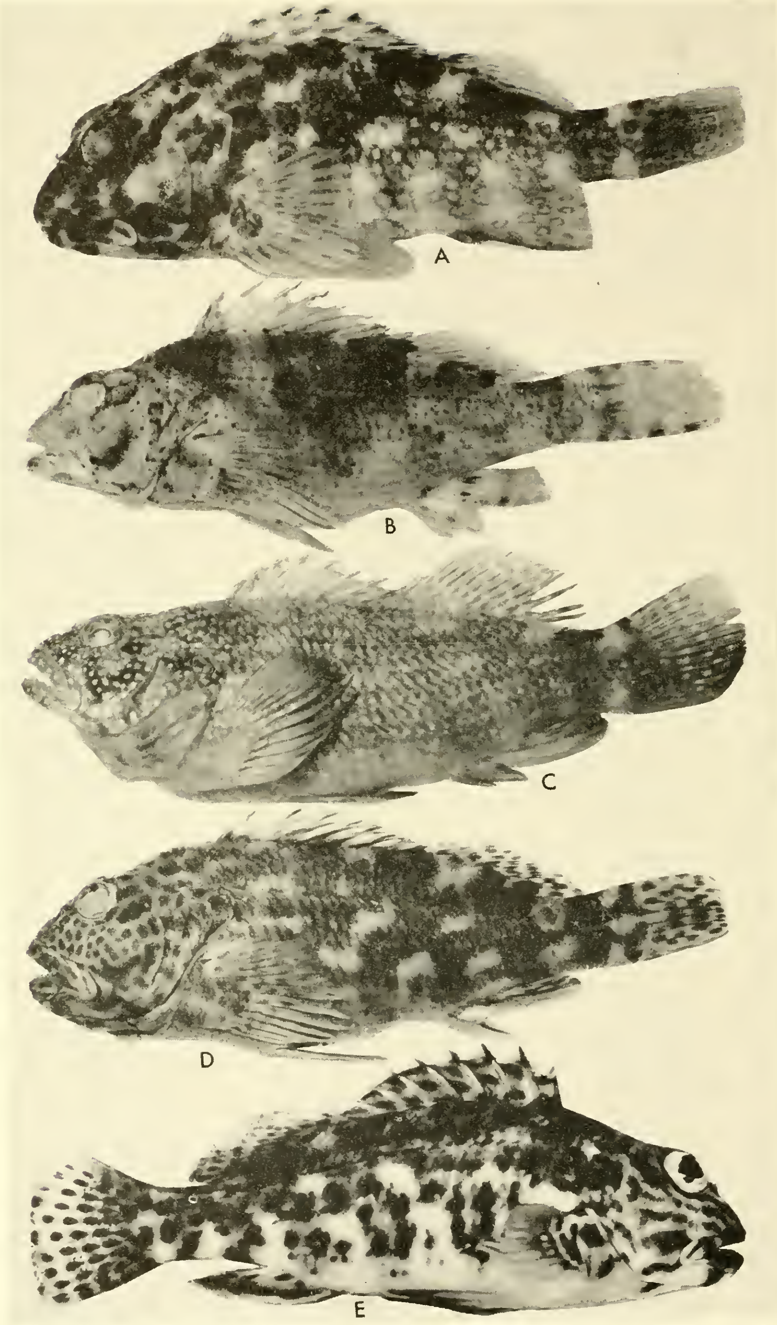
A, *Cheilio inermis* (Forskål), after Bleeker; B, *Thalassoma lutescens* (Lay and Bennett), after Jordan and Snyder; C, *T. fuscum* (Lacepède), USNM 112725; D, *T. hardwickei* (Bennett), USNM 152306, from Samoa; E, *Stethojulis linearis*, new species, holotype from Bikini; C and E, photographs of Marshall Islands specimens.



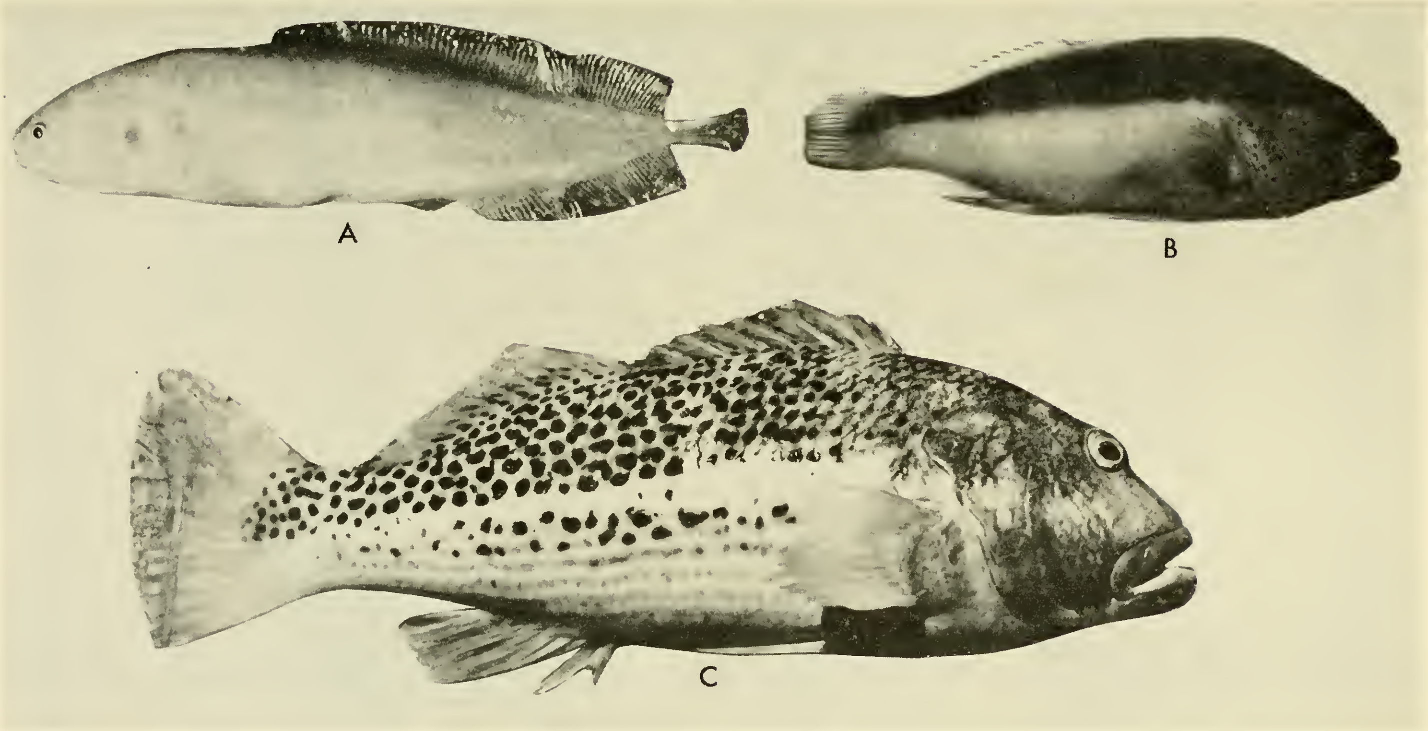
Pharyngeal mills of five genera of parrotfishes. Upper pharyngeal bones are paired, lower ones consist of a single bone. A, *Chlorurus bicolor* (Rüppell), USNM 147231, from the Philippines; B, *C. pulchellus* (Rüppell), USNM 157248, from the Philippines; C, *Calotomus spinidens* (Quoy and Gaimard), USNM 160437, from the Celebes; D, *Scarops rubroviolaceus* (Bleeker), USNM 147267, from the Celebes; E, *Scarus aeruginosus* Cuvier and Valenciennes, USNM 157047, from the Philippines; F, *Leptoscarus vaigiensis* (Quoy and Gaimard), USNM 150224, from Cebu Isl.



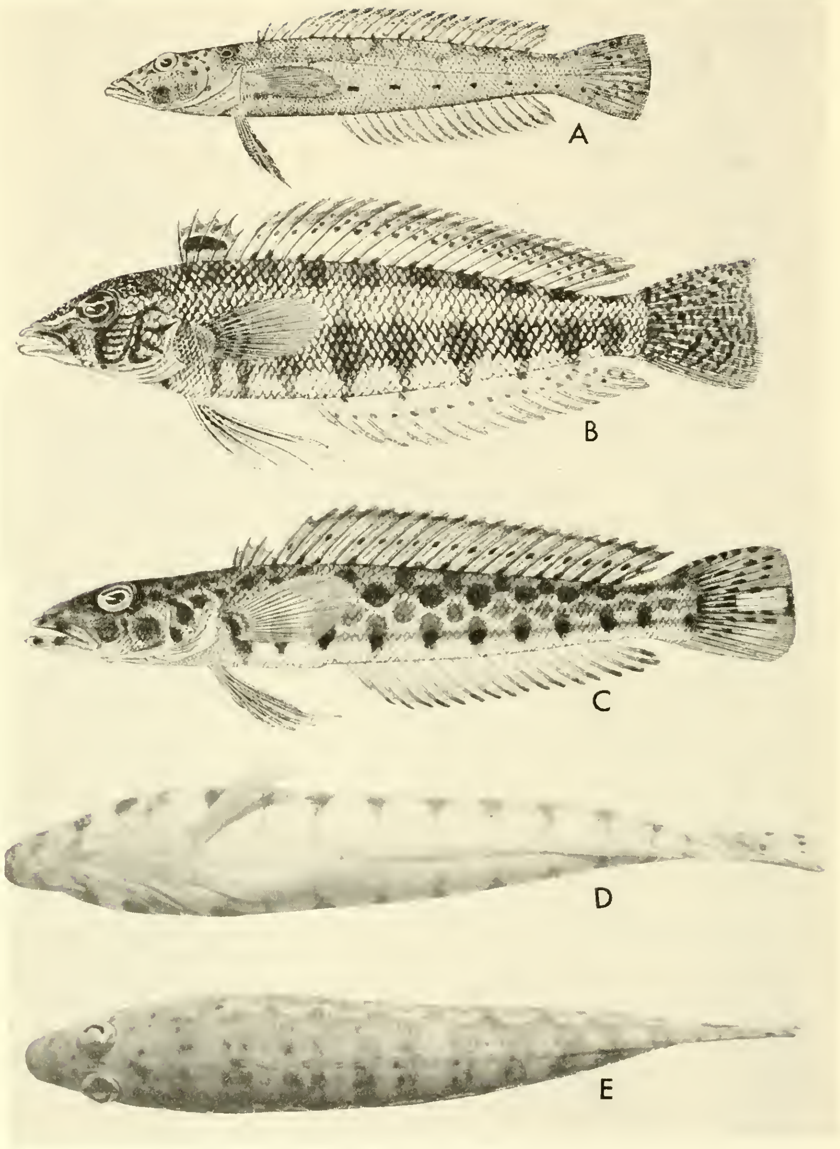
A, *Chlorurus bicolor* (Rüppell), adult; B, *C. pulchellus* (Rüppell); A and B, photographs from color drawings in *Albatross* Philippine collection; C, *Calotomus spinidens* (Quoy and Gaimard), USNM 160437, photograph of color drawing in *Albatross* Philippine collection; D and E, *Leptoscarus vaigiensis* (Quoy and Gaimard): D, female, E, male, both after Bleeker.



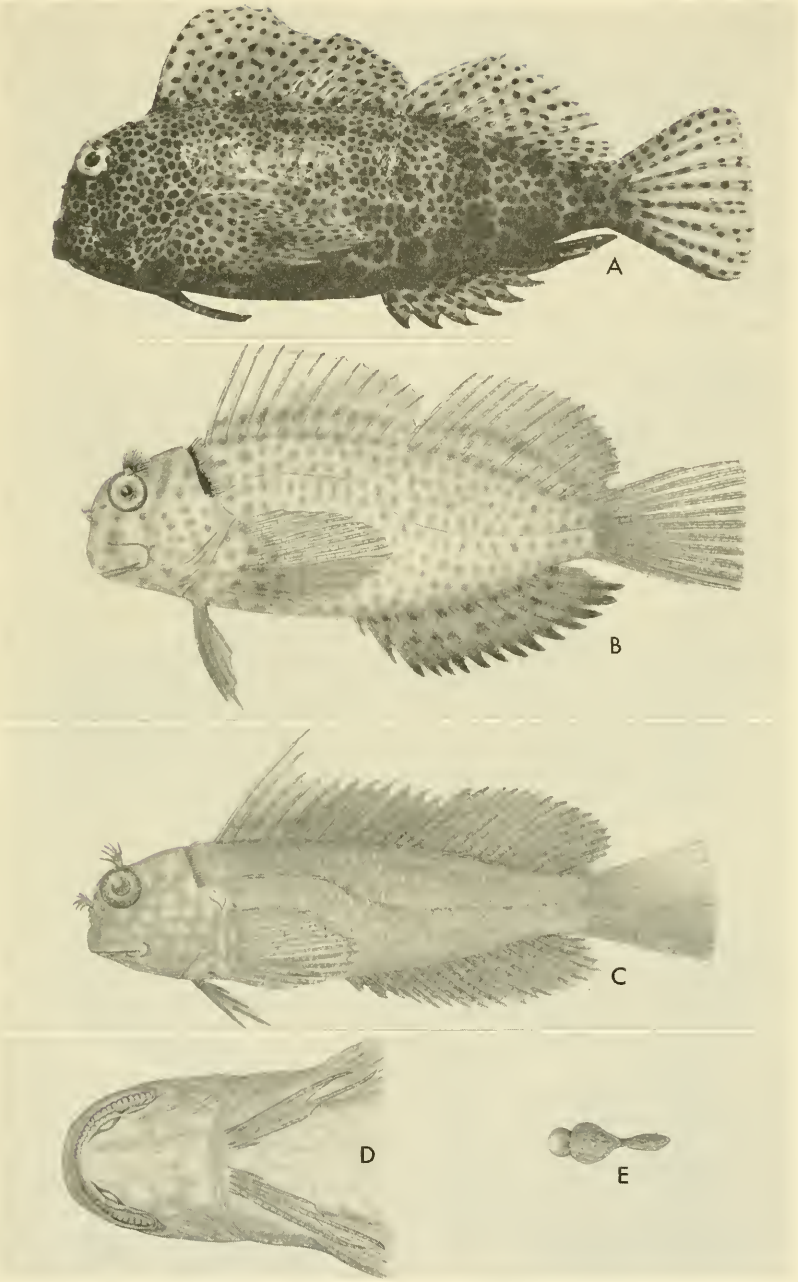
A, *Cirrhitus alternatus* Gill, after Schultz; B, *C. nigropunctatus* Schultz; C, *C. albopunctatus* Schultz; D, *C. spilotoceps* Schultz; E, *C. pinnulatus* (Bloch and Schneider), from Bikini kodachrome; B–D, from figures of the types after Schultz.



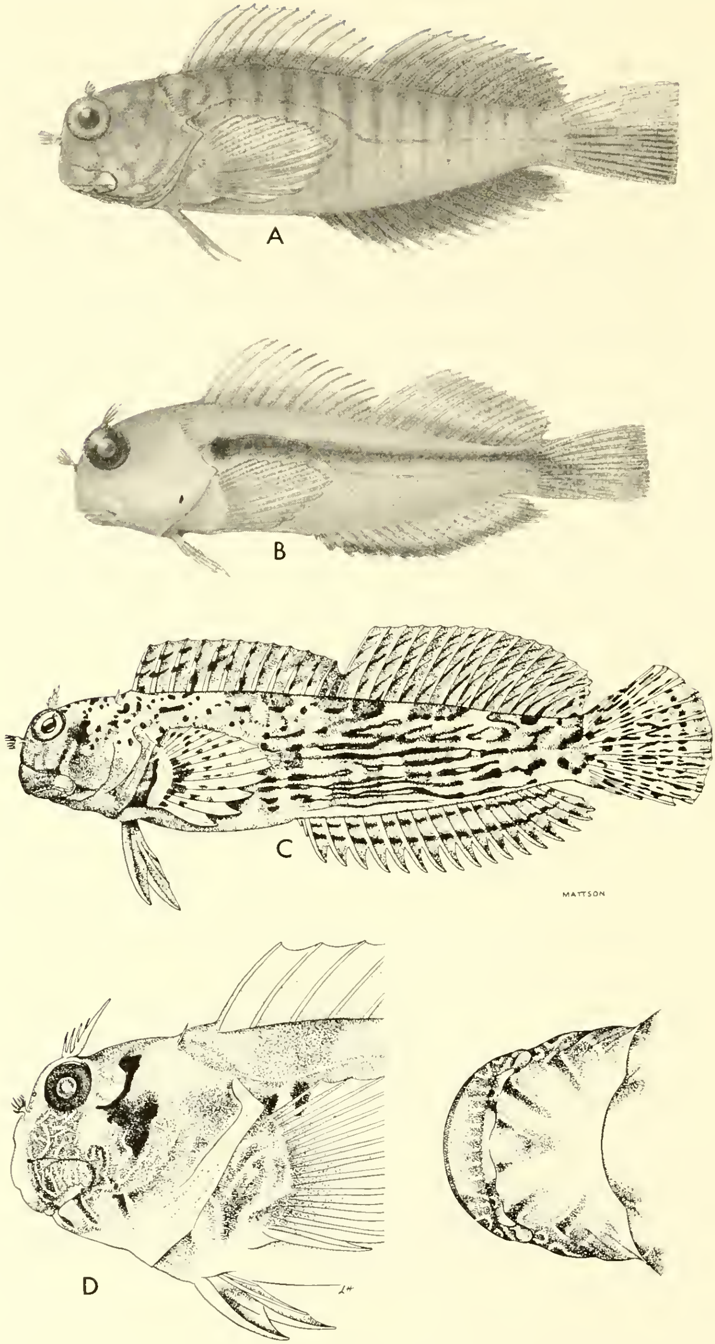
A, *Dinematichthys iluocoeteoides* Bleeker, from Bikini kodachrome; B, *Paracirrhites forsteri* (Bloch and Schneider), USNM 166716 from Arno Atoll; C, *P. hemistictus* (Günther), female, from Bikini kodachrome.



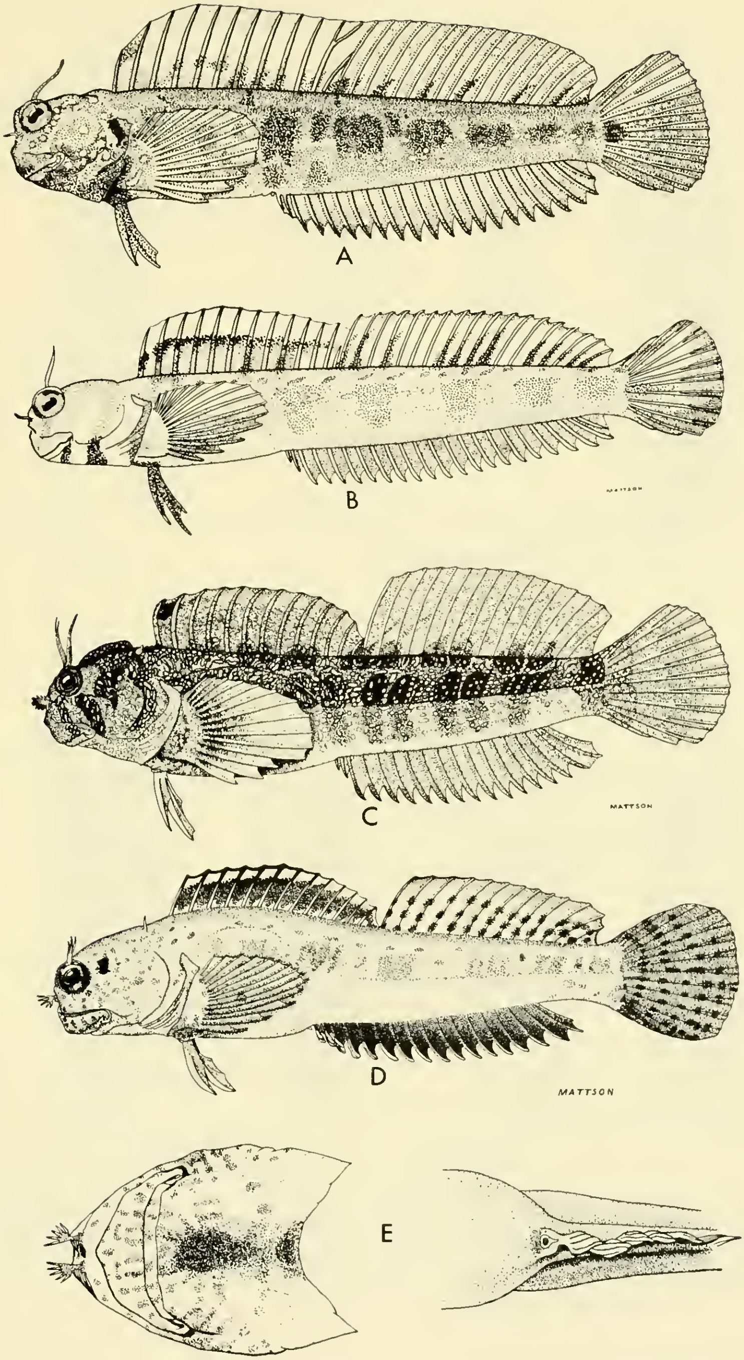
A, *Parapercis clathrata* Ogilby, after Martin and Montalban; B, *P. cylindrica* (Bloch); C, D, and E, *P. cephalopunctatus* (Seale); B and C, photographs of color drawings in the *Albatross* Philippine collection; D and E, both from Bikini kodachromes.



A, *Exallias brevis* (Kner), from a Bikini kodachrome; B, *Cirripectes fuscoguttatus* Strasburg and Schultz, holotype, USNM 113634, from Rongerik Atoll; C, D, and E, *C. stigmaticus* Strasburg and Schultz: C, holotype, USNM 164962, male, 63 mm. standard length, from Rongerik Atoll, D and E, underside of head and enlargement of first anal ray, respectively, paratype, USNM 164963, male, 66 mm., from Rongerik Atoll; B–E, drawn by A. M. Awl.



A and B, *Cirripectes sebae* (Cuvier and Valenciennes), drawn by A. M. Awl: A, female, 47 mm. in standard length, B, male, 33 mm.; C, *Entomacrodus aneitensis* (Günther); D, *E. niuafoouensis* (Fowler); C and D, courtesy of W. M. Chapman.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B
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D
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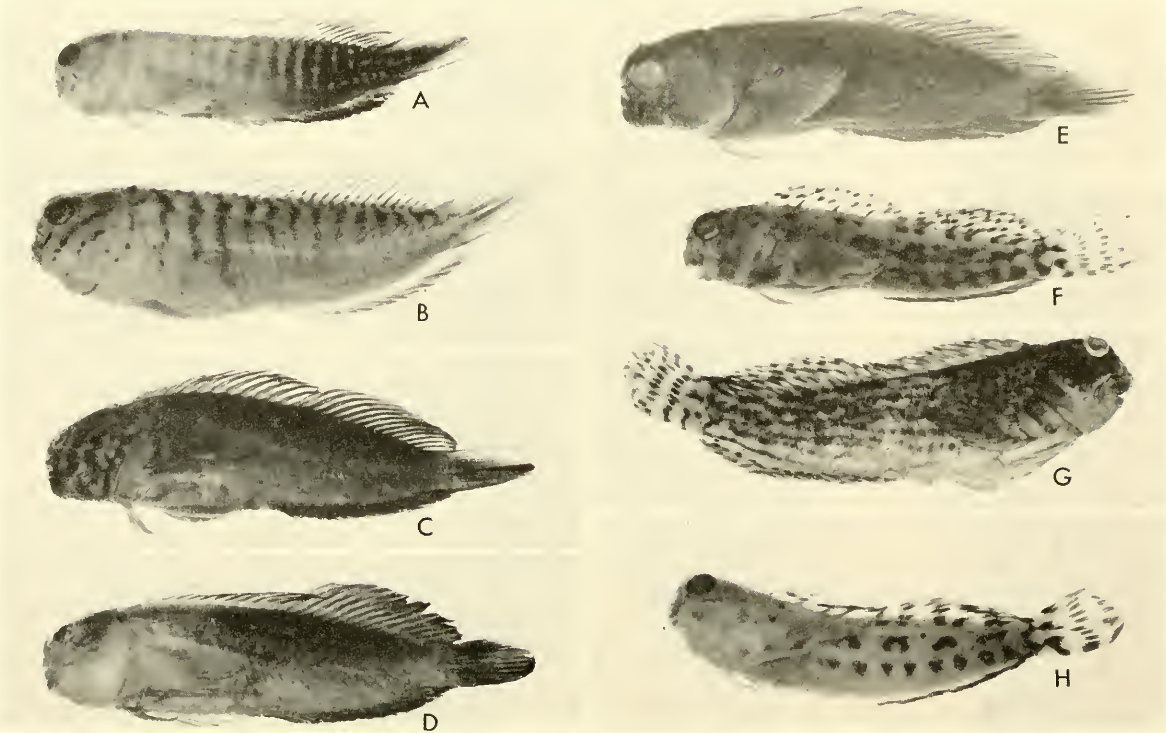
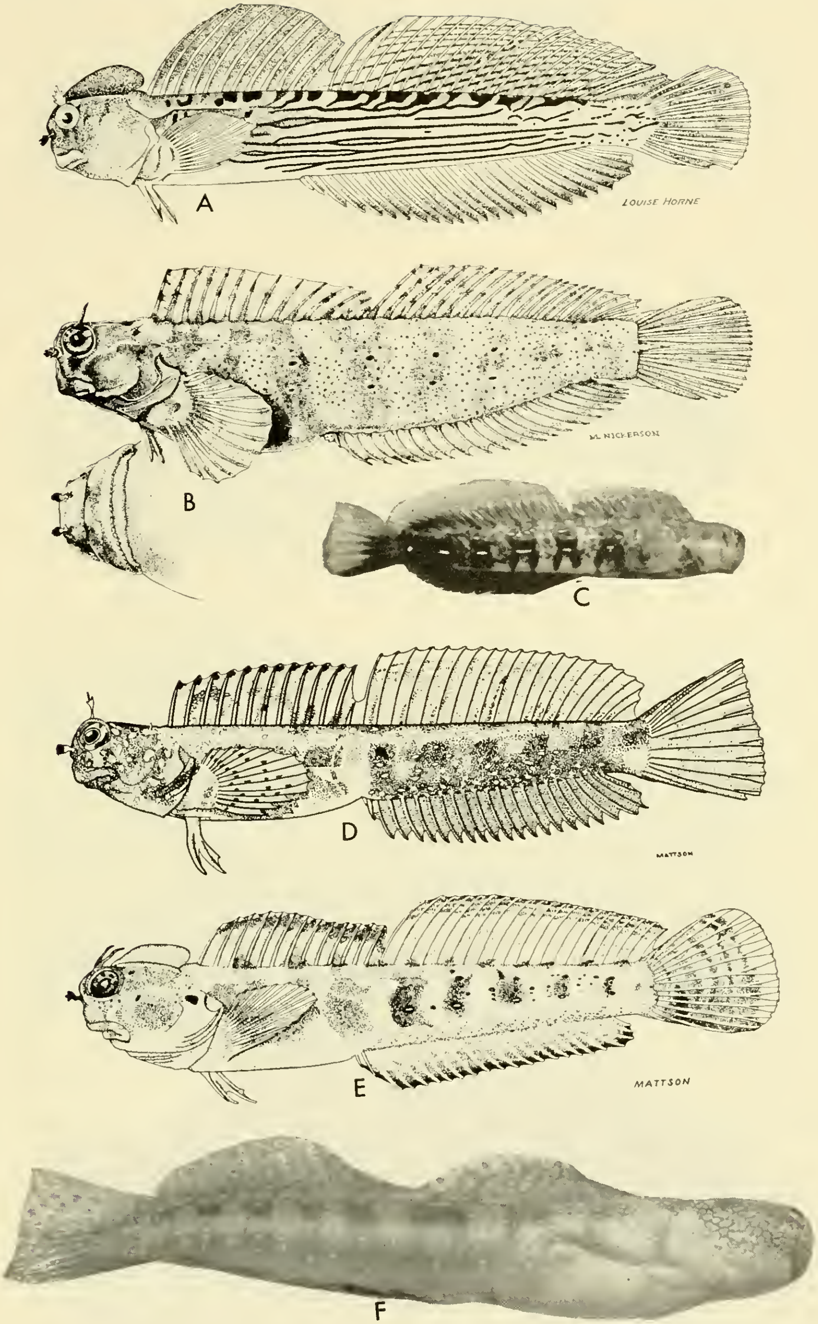
E

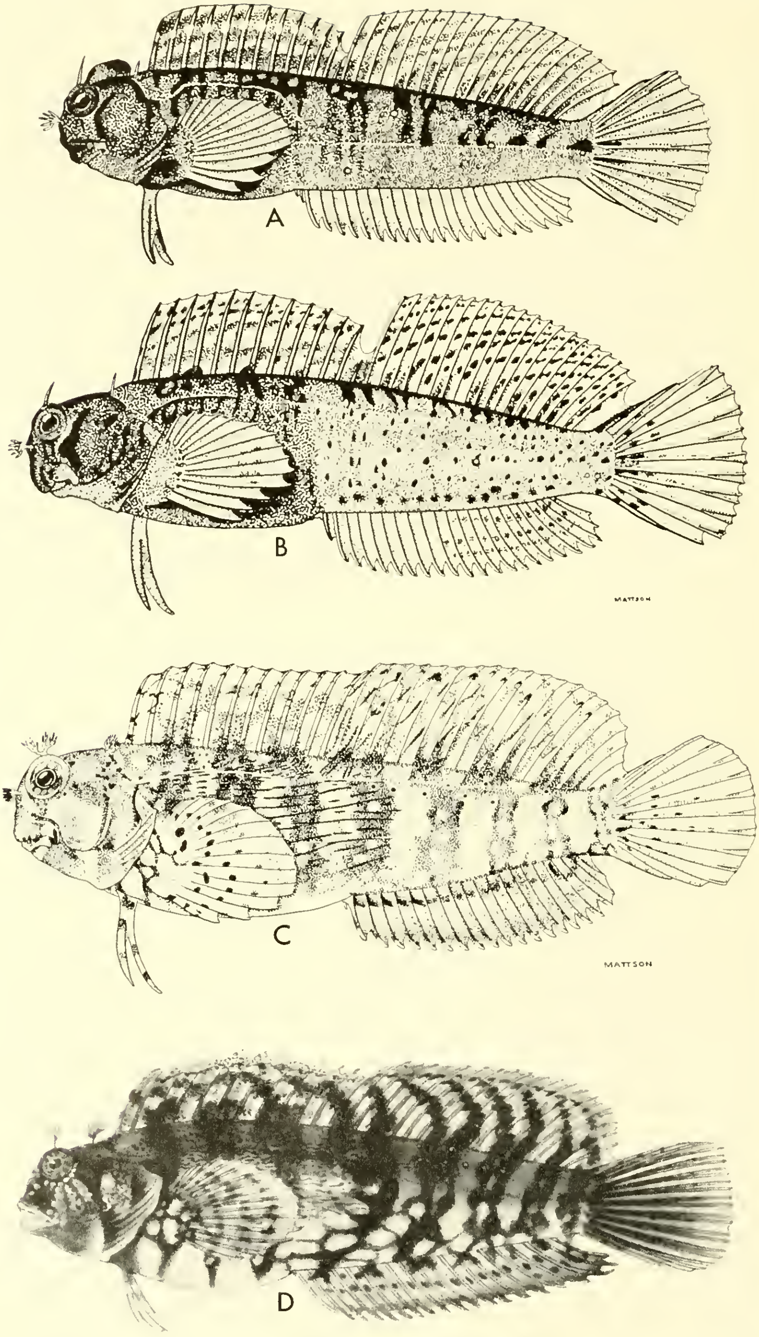
A, *Rhabdoblennius snowi* (Fowler); B, *R. rhabdotrachelus* (Fowler and Ball); C, *Entomacrodus stellifer* (Jordan and Synder); D and E, *E. thalassinus* (Jordan and Seale); A–E, courtesy of W. M. Chapman.



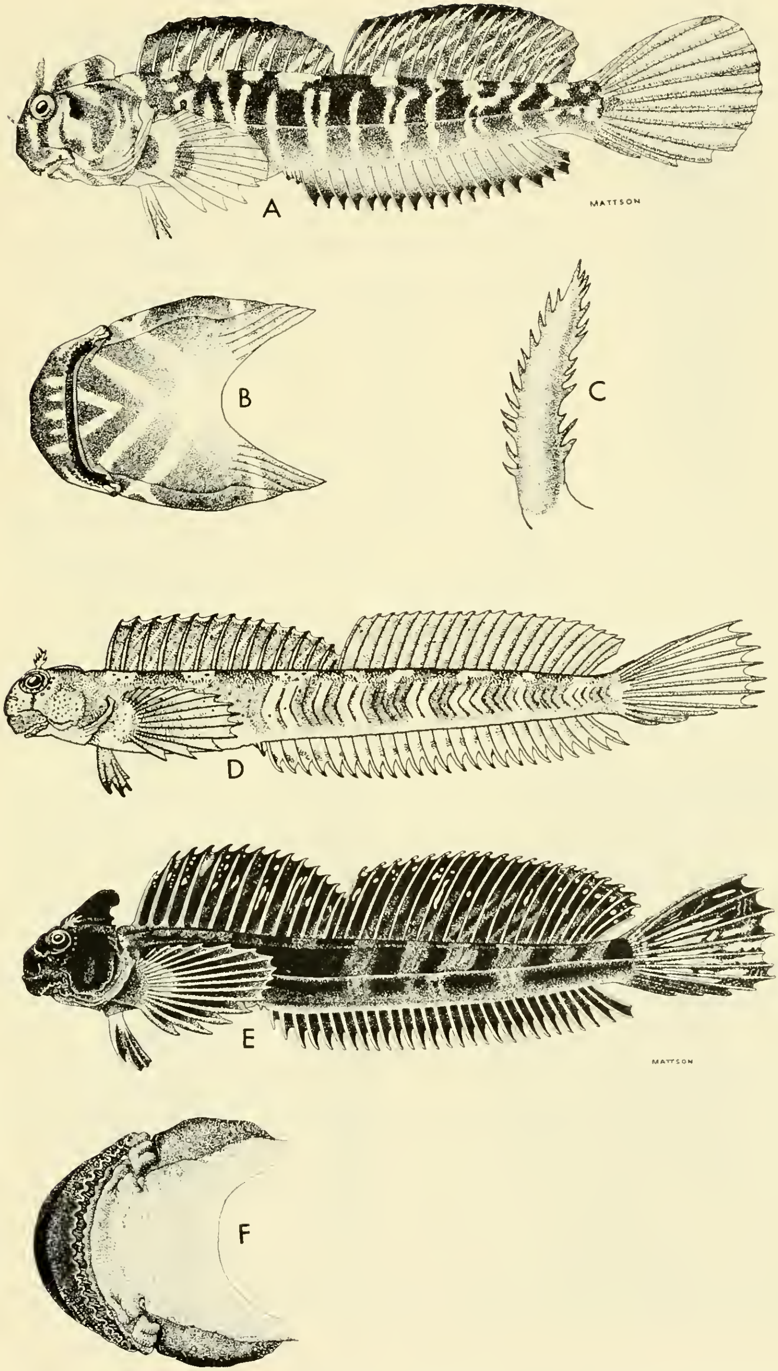
A, B, C, *Cirripectes quagga* (Fowler and Ball): A, young male, USNM 142119, from Bikini Atoll, B, female USNM 142119, from Bikini Atoll, C, adult female, USNM 142121, from Rongerik Atoll; D, E, *C. variolosus* (Cuvier and Valenciennes): D, female, USNM 142107 from Rongerik Atoll, E, male, USNM 142110 from Kwajalein Atoll; F, G, *Entomacrodus decussatus* (Bleeker): F, young, USNM 115474, from Tutuila Isl., Samoa; G, adult, USNM 139838, from Guam; H, *E. aneitensis* (Günther), young, USNM 123936, from Guam.


A
LOUISE HORNE
M. NICKERSON
B
C
D
MATTSON
E
MATTSON
F

A, *Istiblennius lineatus* (Cuvier and Valenciennes); B and C, *I. paulus* (Bryan and Herre); D, *I. coronatus* (Günther); E, *I. cyanostigma* (Bleeker); F, *I. rodenbaughi*, holotype of new species; A, B, D, E, courtesy of W. M. Chapman; C and F, from Bikini kodachromes.



A, B, *Istiblennius edentulus* (Bloch and Schneider): A, male, 62 mm. in standard length, B, female, 72 mm.; C and D *Salarias fasciatus* (Bloch); A to C, courtesy of W. M. Chapman; D, photograph of color drawing in the *Albatross* Philippine collection.


A
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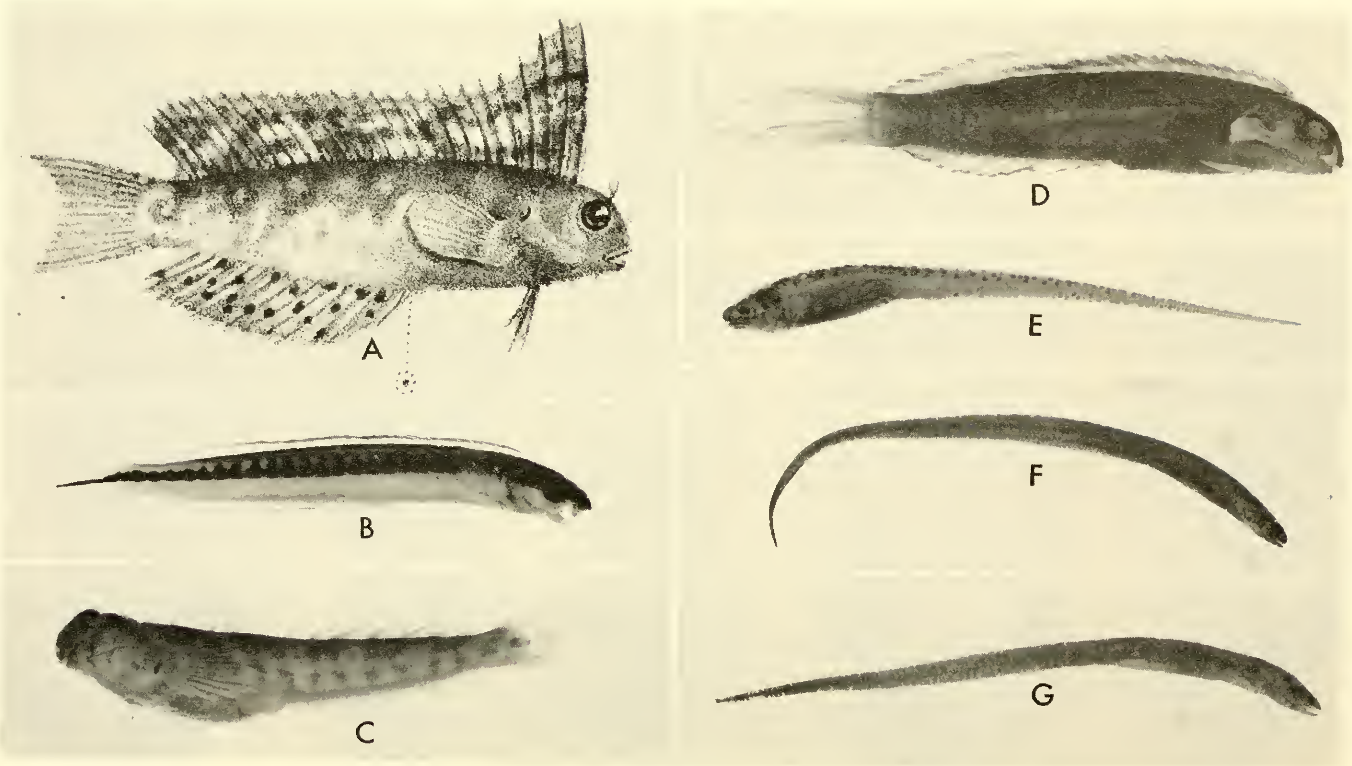
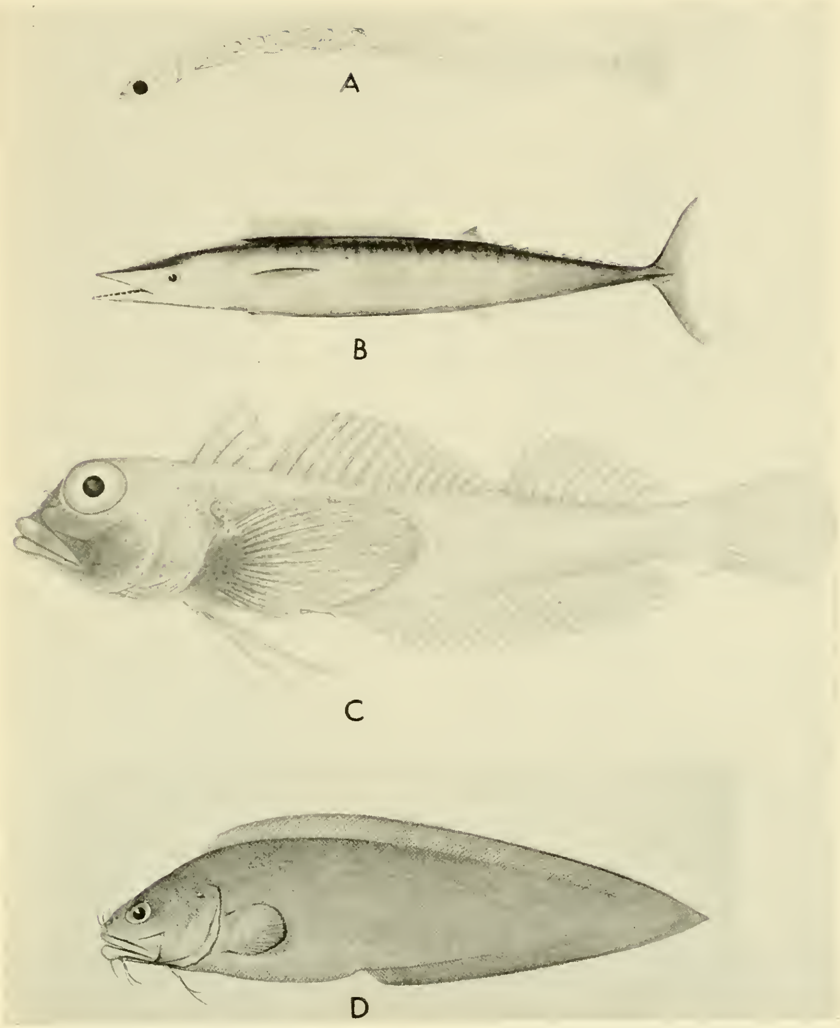
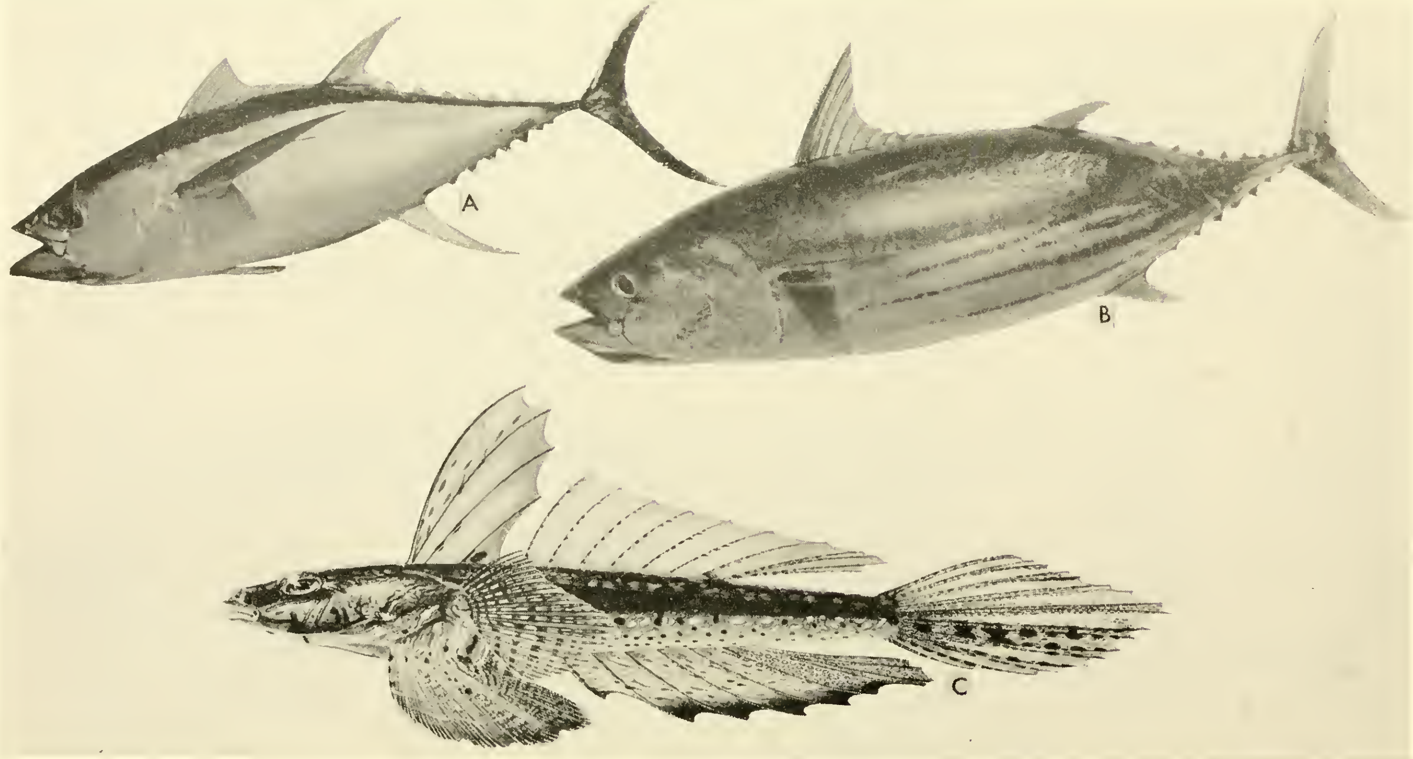
A, B, and C, *Alticus semicrenatus* Chapman, holotype, SNHM 29487: B, underside of head, C, orbital tentacle enlarged; D, E and F, *A. saliens* (Lacepède): D, female, E, male, F, underside of head of E.



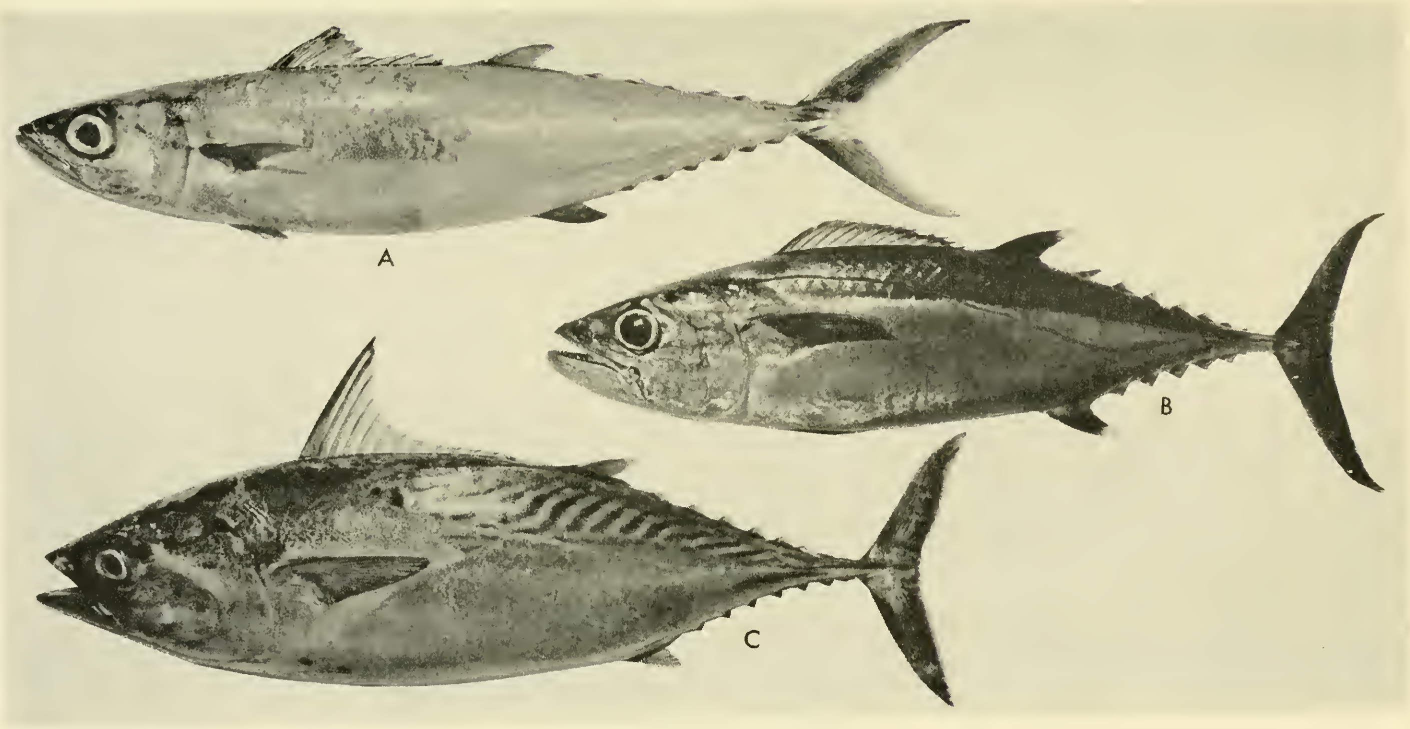
A, *Petroscirtes mitratus* Rüppell, after Rüppell; B, *Runula tapeinosoma* (Bleeker), USNM 167328, from Onotoa Atoll; C, *Praealticus natalis* (Regan), USNM 111877, from Guam; D, *Meiacanthus atrodorsalis* (Günther), USNM 142224, from Rongelap Atoll; E, *Carapus mourlani* (Petit), USNM 140947, from Rongerik Atoll; F, *Jordanicus gracilis* (Bleeker), USNM 140949, from Bikini Island; G, *Encheliophis vermicularis* Müller, USNM 124249, from Guam.



A, *Schindleria praematurus* (Schindler), after Bruun; B, *Acanthocybium solandri* (Cuvier and Valenciennes), after Walford; C, *Helcogramma capidata* Rosenblatt, new species, holotype, SNHM 52010 (drawing by Dorothea B. Schultz); D, *Brotula multibarbata* Temminck and Schlegel, after Jordan and Evermann.



A, *Neothunnus albacora macropterus* (Temminck and Schlegel); B, *Katsuwonus pelamis* (Linnaeus); C, *Callionymus calliste* Jordan and Fowler; A and B, photographs of Bikini specimens.



A. *Grammatorcynus bilineatus* (Rüppell); B. *Gymnosarda nuda* (Günther); C. *Euthynnus affinis yaito* Kishinouye; all are photographs of Bikini specimens.

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